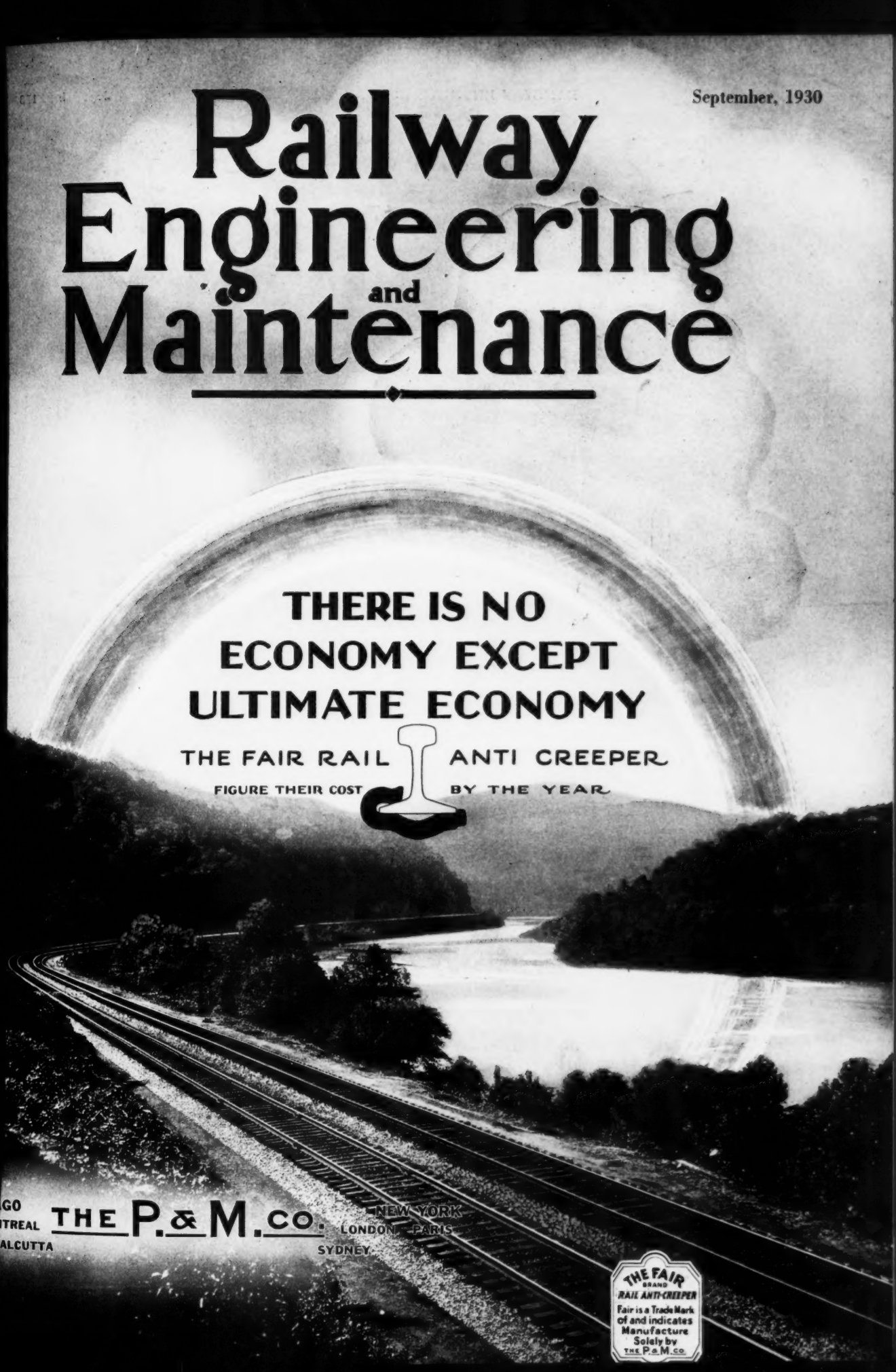
September, 1930

Railway Engineering and Maintenance



RAILWAY ENGINEERING AND MAINTENANCE
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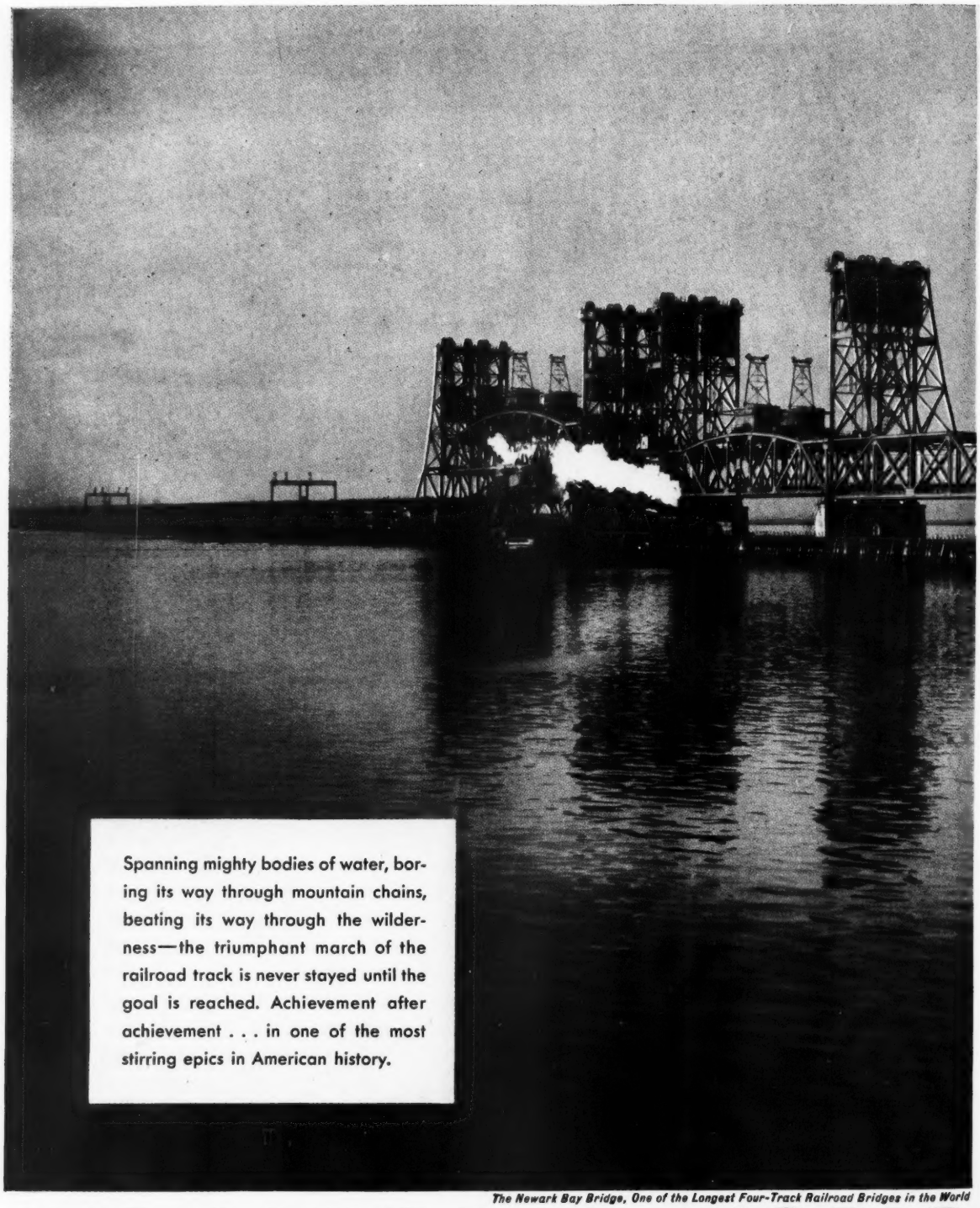
Alphabetical Index to Advertisers, Page 56 Classified Index to Advertisers, 52-54

ACHIEV



Spanning mighty bodies of water, boring its way through mountain chains, beating its way through the wilderness—the triumphant march of the railroad track is never stayed until the goal is reached. Achievement after achievement . . . in one of the most stirring epics in American history.

The Newark Bay Bridge, One of the Longest Four-Track Railroad Bridges in the World

THE RAILROAD WORLD

EMENT..

A2—Heavy Duty Section Car
6-11 H. P.—Steel Girder Frame
Seats 12 Men

ACHIEVEMENT, no matter how spectacular, is based on knowledge, carefully weighed and patiently applied. In motor cars, for instance, no achievement is so remarkable as this: ***One manufacturer made more than half the motor cars now in service!*** Fairmont.

To be proclaimed Leader in such a highly competitive field is indeed an achievement. But, here, again, knowledge and research were behind it—applied toward the lowering of maintenance costs. That Fairmont engineering has attained this goal and established records of ***Lowest Over-All Cost*** is known throughout the Railroad World. Evidenced by the preference shown above.

For efficiency and economy, put Fairmont Railway Motor Cars to work.

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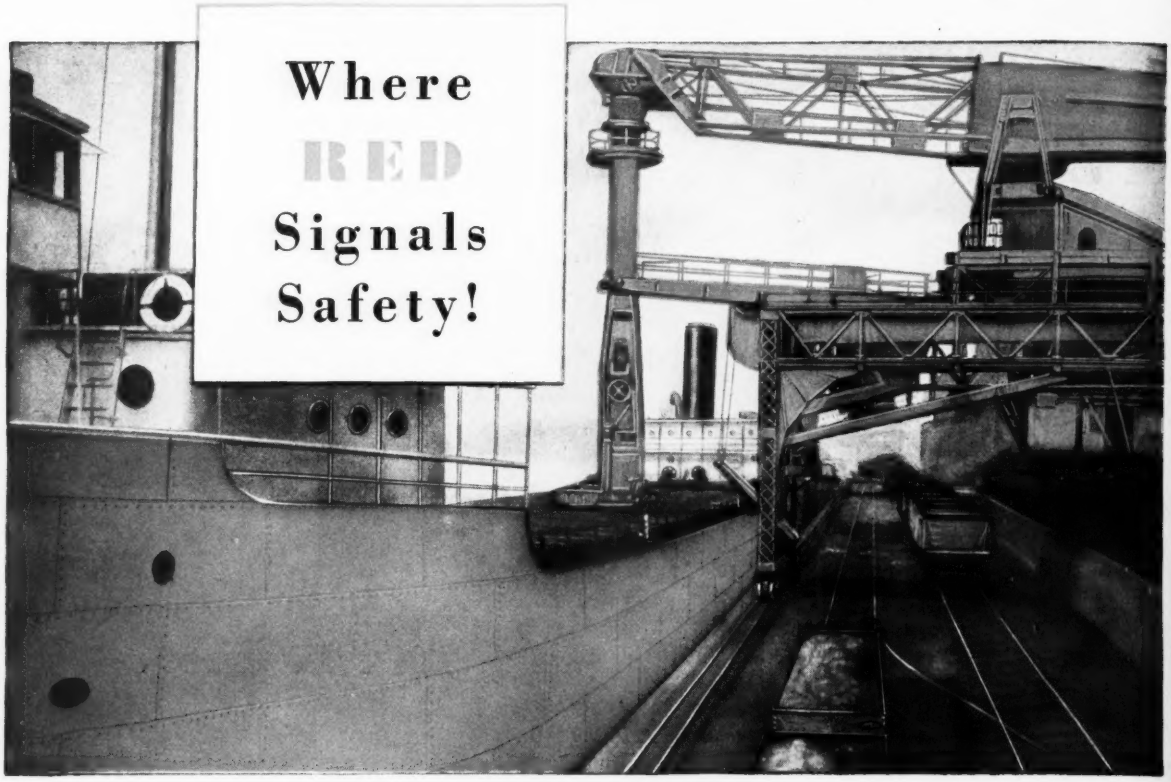
FAIRMONT RAILWAY MOTORS, Ltd., Toronto, Canada *Foreign Representative:* BALDWIN LOCOMOTIVE WORKS

Manufacturers of section motor cars, inspection motor cars, gang and power cars, weed burners, ballast discers, ball and roller bearing engines, push cars and trailers, roller axle bearings, wheels, axles and safety appliances

Fairmont Mudge

Performance on the Job Counts

KNOWS FAIRMONT



Worth Erecting... worth Protecting with RED LEAD

LARGE iron and steel structures exposed to the elements—dock and yard equipment, for instance—present a problem to engineers and others responsible for their proper maintenance. The larger the investment, the greater the possible loss through depreciation and the greater the need for the best protection modern science can provide.

Pure red-lead paint is recognized as the most effective barrier to depreciation in metal structures. It adheres tenaciously to iron and steel surfaces. It *seals out* corrosion—prevents moisture and other destructive agents from getting at the metal.

By specifying Dutch Boy when purchasing red lead, you are assured of obtaining a fine, uniform, highly oxidized pigment—a paint material that has the endorsement of engineers and technical men in many industrial fields.

DUTCH BOY
RED LEAD

Dutch Boy Red Lead is available in two forms—paste and liquid. The latter—ready for the brush—is supplied in six colors—natural orange-red, light and dark brown, light and dark green, and black. The paste is available in natural orange-red and can be shaded to dark colors.

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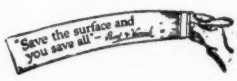
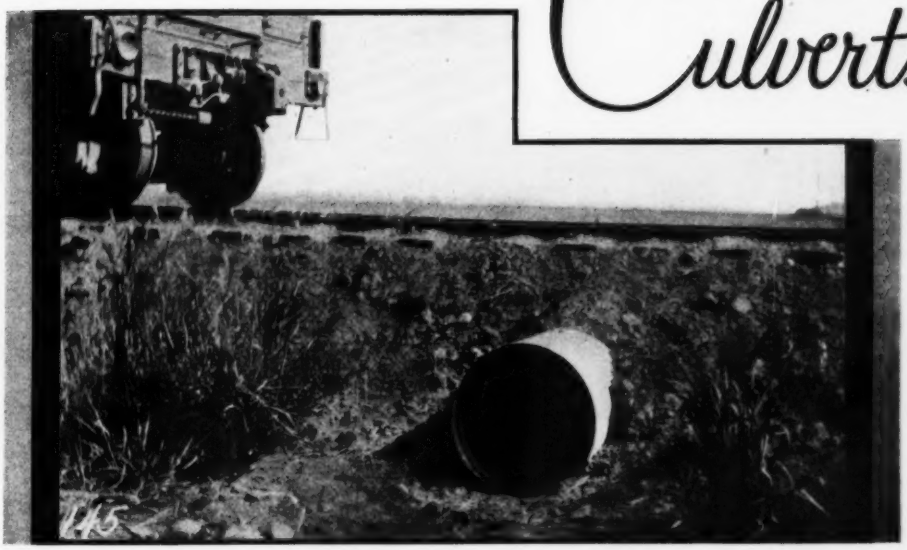
New York, 111 Broadway; Buffalo, 116 Oak St.; Chicago, 900 West 18th St.; Cincinnati, 659 Freeman Ave.; Cleveland, 820 West Superior Ave.; St. Louis, 722 Chestnut St.; San Francisco, 2240-24th Street; Boston, National-Boston Lead Co., 800 Albany St.; Pittsburgh, National Lead & Oil Co. of Pennsylvania, 316 Fourth Ave.; Philadelphia, John T. Lewis & Bros. Co., Widener Building.



The Best Buy on the Market Today

OFFICIALLY, *By the Test of Time, Nature has OK'd*

ARMCO *Culverts*



Under shallow fills and deep ones, in every State and Canada, hundreds of thousands of Armco Culverts are serving the railroads —keeping roadbeds dry, firm — safe for heavy, fast-moving traffic.

Choose them CONFIDENTLY

CLAIMS are not made for Armco Culverts. Facts—plain facts are recited—facts that need no verbal brass band to support them. Officially, by the test of time, Nature has OK'd Armco Culverts as the longest-lasting product of its kind in use.

Knowing the difference between facts of performance and laboratory "proofs" of potential or probable service, railroads select culverts with definite ease.

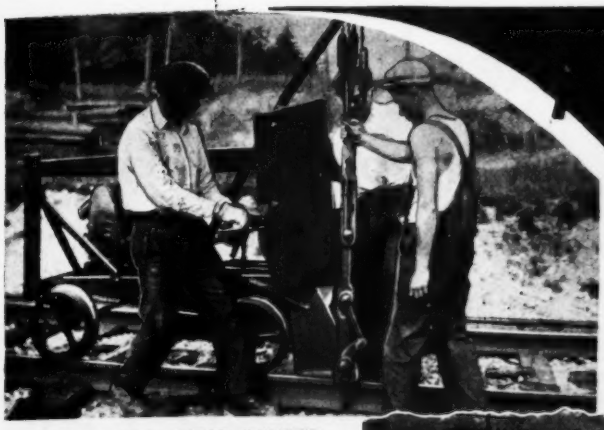
We say, simply, Armco Culverts, made uniformly pure since 1906, endure. We say they have endured for more than 24 years and that their true life expectancy is not yet known. Time will reveal their real durability.

We say (or suggest), simply, choose Armco Culverts and save money. Because the longer life of Armco Culverts automatically means greater economy.

The swing to Armco Culverts is the natural result of the growing knowledge of the facts about culverts. For new data—recent facts assembled from field studies made by Armco engineers — write to Drainage Headquarters.

Armco culverts and drains are manufactured from the Armco Ingot Iron of The American Rolling Mill Company and always bear its brand.

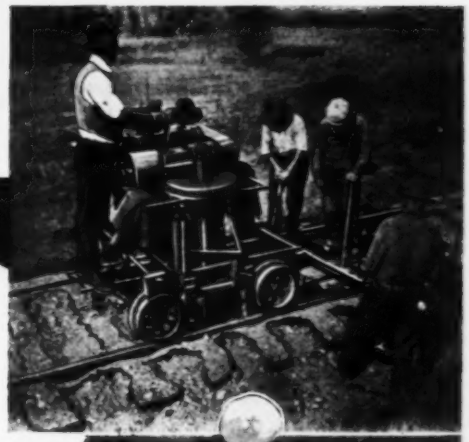
ARMCO CULVERT MANUFACTURERS ASSOCIATION
Middletown, Ohio



NORDBERG SPIKE PULLER

NORDBERG ADZING MACHINES

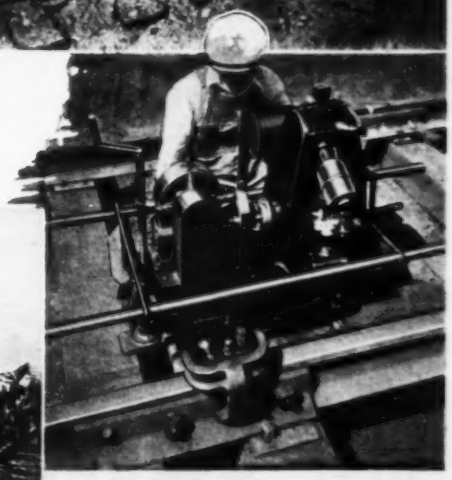
NORDBERG POWER JACK



Two new machines, the Nordberg Spike Puller and the Nordberg Power Drill, have been added to the constantly growing line of Nordberg track machinery.

Like the other machines developed by Nordberg, these new ones multiply man power and raise the standards of track maintenance —as well as reduce labor cost. See them at the Roadmasters' Show, Sept. 16, 17, and 18th.

NORDBERG TRACK SHIFTER



NORDBERG POWER RAIL DRILL

NORDBERG MFG. CO.

Milwaukee Wisconsin

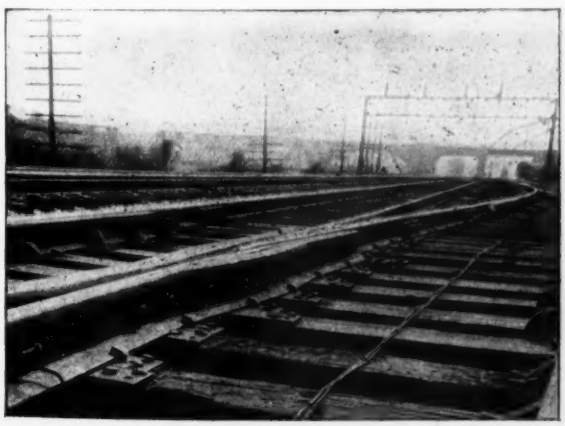
Twin Frog Plates

The track foreman's friend

THE new Bethlehem Twin Frog Plates are an important step forward in better installation and maintenance of frogs. The same set of frog plates will fit any frog and any weight of rail.

Trackmen especially will find that Bethlehem Twin Frog Plates are labor-savers due to their ease of installation. These Twin Frog Plates fit any angle of the frog thus dispensing with special frog plates for each tie position. Further, Bethlehem Twin Frog Plates are interchangeable with those now in use.

Bethlehem Twin Frog Plates are made of rolled steel, in one piece, with a forged hook that fits over the base flange of the rail or frog. Uniform and full bearing of the base of the frog is provided by the combined width of the Twin Frog Plates, saving the tie from injury. The hook fastening of the Twin Frog Plates is much heavier than the fastening afforded by ordinary track spikes, and gives an increased margin of safety in holding power.



This frog on a high-speed main line is securely anchored in position with Bethlehem Twin Frog Plates.

BETHLEHEM STEEL COMPANY

General Offices: Bethlehem, Pa.

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BETHLEHEM

TWIN FROG PLATES

TO protect the confidence of many old friends and as a signal of safety to all future buyers, LOWELL Reversible Ratchet Wrenches have been branded with a bright, flaming red mark of identification.

Send for the new catalog showing the many uses, sizes, types and prices. . . . Use the handy coupon or ask your dealer.

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MANUFACTURED BY
WORCESTER, MASSACHUSETTS, U.S.A.

TREMENDOUS EARNING POWER

due to a wide range of uses and easy adaptability

Burro Crane equipped with 36" magnet operating on flat car.

Burro Crane equipped with ½ yard clamshell bucket for handling bulk materials.

Loading changed out rail on a car which the Burro is hauling.

Make Booth No. 102 at the Roadmasters' Convention your headquarters. See interesting motion pictures of Burro Cranes Model 20 and Model 30 in action. Also get details on the newest Burro Crane Model 15.

Burro Cranes

REGISTERED U.S. PATENT OFFICE

A cordial invitation is extended to visit our plant and see the new Burro Crane Model 15 in operation. This is one of the high lights of the Convention—don't miss it.

CULLEN-FRIESTEDT COMPANY, 1300 S. KILBOURN AVE., CHICAGO, ILL.

Complete Teleweld Service
Rail End Restoration
Slotting New Rail
Frog and Switch Reclamation
Steel Bridge Reinforcement

TELEWELD
A MILE AT A TIME

Below—Rail Ends Before and After Conditioning

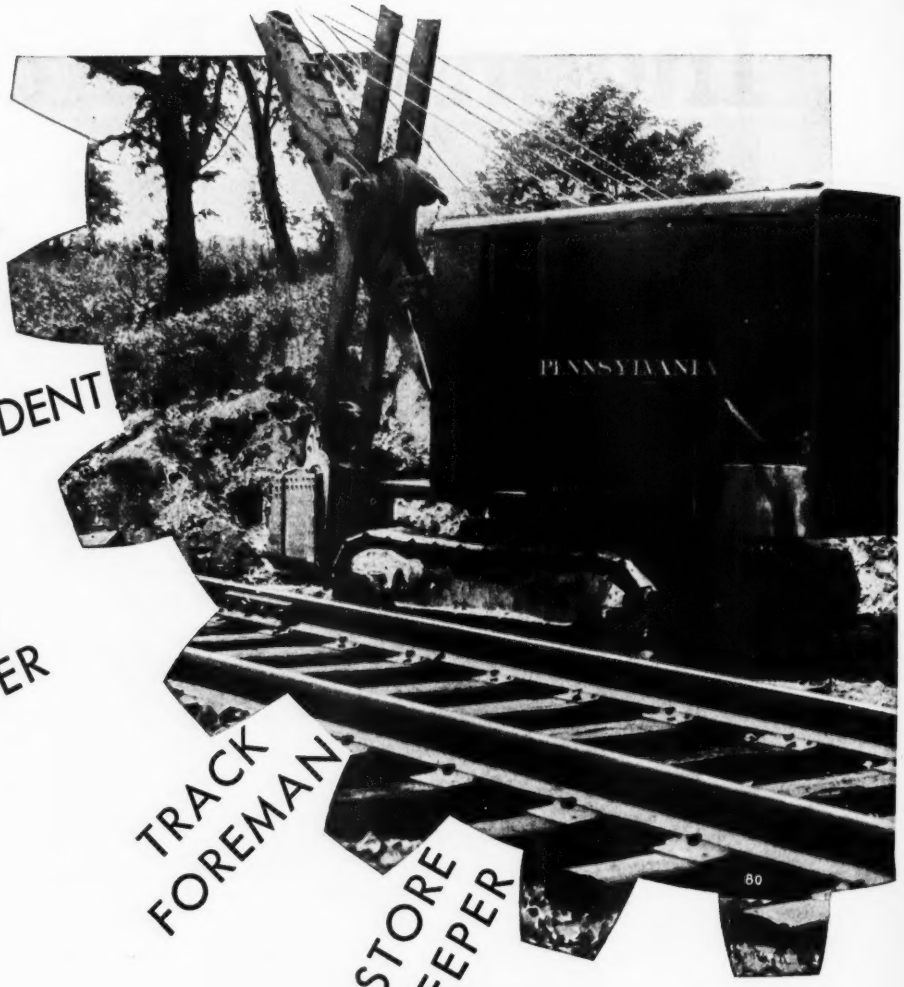
PREVENT NEW RAIL END CHIPPING

With This TELEWELD Slotting Tool

TELEWELD engineers score again with the TELEWELD Slotting Tool *for conditioning new rail,* and preventing end-chipping at its source by beveling the rail end *before* the new rail has a chance to chip! ◆ Here is a proven method for reducing rail maintenance expense, and adding years of life to your steel! ◆ In actual service it has proved its worth time and again. In a test, one road beveled the rail ends in a five mile section of track, leaving the adjoining five miles untreated. Later inspection revealed chipped rail ends only in the untreated section; the Teleweld-beveled section was in perfect condition! ◆ About eight months after new steel has been laid the metal has flown toward the rail ends. Then is the time to apply this simply-operated, economical tool for beveling rail ends and preventing chipping. ◆ The TELEWELD Slotting Machine is leased on a mileage basis. You pay only for actual miles serviced. Your unskilled laborer can operate it and average from one-half to one mile of track per day. Manually operated, it requires neither power nor power plant. Light in weight, it is easily moved. ◆ Today true economy is paramount. An ounce of prevention is worth a pound of cure. A few cents invested per rail end today saves dollars in rail maintenance and replacement tomorrow! ◆ Send for complete details on the attractive TELEWELD Slotting Tool Leasing Plan *today!*

ELECTRIC RAILWELD SALES CORPORATION, RAILWAY EXCHANGE BLDG., CHICAGO

New York ◆ Cleveland ◆ Salt Lake City ◆ Boise ◆ Spokane ◆ San Francisco



IT'S GEARED TO THEIR JOBS

From the "super" down, every man in the division finds his job easier when a Bucyrus-Erie 2030 is assigned to the digging and lifting.

Maintenance and construction men like the time it saves, the number of different things it does well, the mileage it covers (rides a gondola without dismantling), its gratifying economy at the hardest jobs.

Trainmen, too, appreciate the 2030. Assigned to the work train, it does its part unfailingly and helps keep the signals clear.

The 2030 is more than an ordinary gasoline convertible with a ¾-yard rating. It can be *quickly* converted, *on-the-job*. And "¾-yard" doesn't begin to describe its big digging output as a shovel or dragline on right of way work, or the large daily tonnage of gravel, lumber, rails and scrap it moves as a clamshell or lifting crane.

With new speed, power, stamina, handiness, the 2030 is the best effort of Bucyrus-Erie, shovel builders for 50 years. Send for a description.

Representatives throughout the U. S. A. Offices or distributors in all principal countries. *Branch Offices*: Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Dallas, San Francisco.

A-165—9-30—REM

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You can be *sure* of G-E 1850 Insulating Paper. It doesn't carbonize, under motor operating heats. It resists moisture, and it's mechanically strong . . . doesn't split in tight slots, leaving hidden cause for later trouble.

There are no pinholes in it . . . no thin spots . . . no brittle patches.

Careful selection of pulps from all over the world, special processes, hot rolling under tremendous pressures, long manufacturing experience—in a plant devoted to this product—all these factors make G-E 1850 *super* insulating paper.

You will understand why it can add life to hard-driven motors if you will accept a sample from us. Write today to Section M-899, Merchandise Department, General Electric Company, Bridgeport, Conn.

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Core Solder and Fluxes.

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GENERAL ELECTRIC

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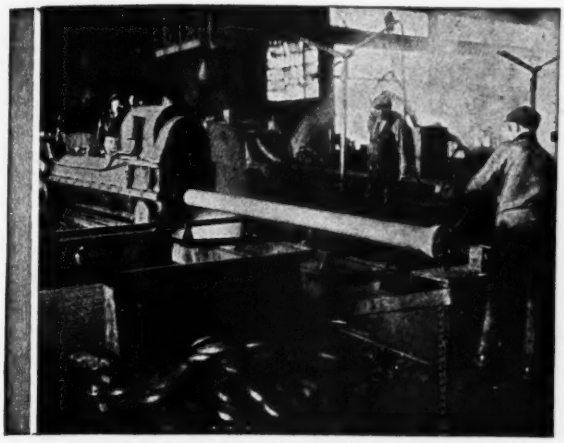
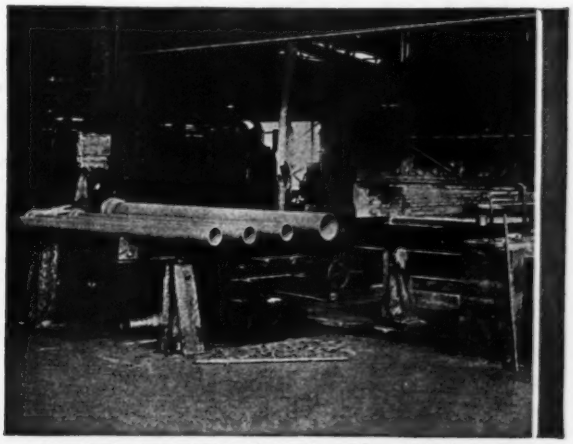
centrifugal casting } and { controlled annealing..



As soon as the pipe is formed in the mold, the bell is secured by a locking device and the deLavaud machine moves slowly backward.



Immediately after coming from the machines, deLavaud pipe is placed in a furnace where accurately controlled heat uniformly anneals every length.

combine to give strength and flexibility to deLavaud pipe

THERE are two fundamental reasons for the strength and flexibility of deLavaud pipe metal. The first reason is the centrifugal method of casting in the water-jacketed deLavaud machine.

In this machine, the iron is cast under a pressure which drives out impurities with a force many times greater than gravity. This pressure brings about an unusually dense metal structure.

The cooling action of the water jacket also contributes to the strength of deLavaud pipe metal by breaking down and evenly distributing the non-ferrous particles.

The second reason for the strength and flexibility of deLavaud pipe is the controlled annealing process. Every length of deLavaud pipe is placed in an especially designed furnace, as shown at the upper right. Here, accurately controlled temperatures anneal every length from end to end, eliminating casting strains.

deLavaud pipe is made by modern methods to meet modern demands. Being light in weight, it is easy to handle. Easy to cut and tap. And, it offers at least 5% greater carrying capacity for the same outside diameter.

deLavaud pipe is manufactured in strict accordance with the specifications of the American Water Works Association and the American Gas Association as well as in the thicknesses and weights of the United States Government Specifications. The new deLavaud Handbook gives complete information. Write for your free copy today.

United States Pipe and Foundry Co., Burlington, N.J.

Sales Offices: New York, Philadelphia, Pittsburgh, Cleveland, Buffalo, Chicago, Dallas, Birmingham, Kansas City, Minneapolis, Seattle, San Francisco, Los Angeles

Our pipe bears the "Q-Check" trademark of The Cast Iron Pipe Research Association

No. 21 of a series

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Railway Engineering and Maintenance

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ADDRESS REPLY TO
105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Reader Service

Dear Reader: August 28, 1930
Everywhere

"What is the widest railway gage now in use?" Thus read a cablegram which I received a few days ago from a point which I had never heard of in the interior of Chile, S. A.

"How much oil is required to lay the dust on a 12-ft. width of roadbed? Our conditions are very bad south of Bagdad." This from an engineer on the Iraq Railway in Mesopotamia.

"Can you refer me to a machine that will bind No. 8 gage wire about railway ties to prevent their checking?" This inquiry came from a reader in Japan within the last week.

"What information can you give me regarding the relative durability of paint applied by spray equipment and by the brush?" asked a subscriber in Cuba.

These are typical requests that are received almost daily from the most remote points of the world and in far greater numbers from readers nearer home. Correctly or otherwise, railway men throughout the world look to Railway Engineering and Maintenance and to its parent publication, the Railway Age, for answers to questions that arise on the widest diversity of problems affecting the railways. We regard the fact that so many men look to us for aid in the solution of their problems as a compliment of the highest order. For this reason, we go to great lengths to secure and forward the desired information, even though such inquiries not uncommonly tax our knowledge sorely and frequently require much investigation. This is a service to which you undoubtedly give no thought when you renew your subscription. Neither is it a service which we advertise. Yet many of our readers have told us that the information that we have been able to secure for them has alone been worth many times the cost of their subscriptions.

We do not solicit requests of this kind; it is not a service which we capitalize on. Yet, if there is any information that we may have that will be of help to you in the solution of your problems, we want you, as a subscriber, to feel free to write us. We may not answer your question to your satisfaction, but I can assure you that we will do our best.

Yours very truly,

Elmer T. Howson

ETH*MM Editor.

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Kalamazoo "355" a completely enclosed all-weather Coach-Type Motor Car seating 22 men. Widely used for hauling workmen to and from the job the year 'round. Double-end control.

Kalamazoo "35B" Flat Decked Work Car. A tremendously powerful car for hauling materials and workmen. Handles several trailers easily.

The Kalamazoo "35" Motor Car with standard body seating 30 men. Hauls many more on trailers.

ESTABLISHED 1883

KALAMAZOO MEANS SERVICE TO YOU

Heavy Duty *Service* That Opens Up New Ways to Practical Economies

For "Up-Hill" Work

Kalamazoo 35 is as highly powered and as sturdily built as the heavy automobile truck and takes the place of a work train in transporting men and materials.

Hauling a large crew of men and several loaded trailers up the grades found on hump yards or on logging railroads is one of the jobs it is made for.

And you'll find it at work on many railroads taking men and supplies to construction and bridge jobs and distributing heavy materials to section crews along the line.

Write for catalog information.

KALAMAZOO RAILWAY SUPPLY CO.

Established 1883

KALAMAZOO, MICHIGAN

Another Federal Wall for the *Pennsylvania*

Over a quarter of a mile long, this wall is but one of many retaining walls of Federal 2-piece Cribbing Units erected by the Pennsylvania Railroad over a period of years. Several others are being installed at this time.

The neat masonry-like closed face of this construction, undoubtedly presents the happiest solution for a right-of-way through populated districts.

In addition to this important feature, two piece construction saves material and labor to install—is free of all maintenance—is quickly erected in any weather—assures 100% salvage if moved.

Many prominent roads are standardizing on Federal because of the sound merits of this unique design. Interesting booklet on request.

FEDERAL CEMENT TILE COMPANY, 608 South Dearborn Street, Chicago, Illinois

Concrete Products *for Over 25 Years*

FEDERAL 2 piece Concrete CRIBBING

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Railway Engineering and Maintenance

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Formerly the Railway Maintenance Engineer
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H. F. LANE, *Washington Editor*
M. H. DICK, *Associate Editor*

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Entered at the postoffice at Chicago, Ill., as mail matter of the second class.

At the new Union Station in Chicago more than 200 Ajax One-Piece Manganese Guard Rails are installed in the track layout.

Make 1 Part Do Better Than 33

Behind Racor service stand nine plants specializing in the manufacture and distribution of railroad track turnout and crossing equipment, including Manganese Work for heavy traffic.

GUARD rails which are bolted or clamped to the track rails cannot easily be maintained at the proper distance from the gauge line of the frogs. The very multiplicity of their parts defeats the chances of their fastenings remaining secure under vibration. Frequent adjustment and tightening becomes inevitable.

Ajax One-Piece Guard Rails are spiked directly to the ties and remain in fixed adjustment with the frogs. One piece of Manganese steel displaces 32 small parts. Wear on the rubbing surfaces is very slow. Maintenance cost is greatly reduced.

In every way: stock-keeping, installation, supervision and maintenance, Ajax One-Piece Manganese Guard Rails are more economical than standard O. H. steel guard rails; in addition, they promote safety.

RAMAPO AJAX CORPORATION

RACOR PACIFIC FROG AND SWITCH COMPANY, Los Angeles • Seattle
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Railway Engineering and Maintenance

Volume 26 SEPTEMBER No. 9

Switch Inspection

IN VIEW of the emphasis that has long been placed on the rail as the primary element of weakness in the track structure, it may be surprising to some to learn that, among the 130 train accidents of sufficient seriousness to warrant investigation by representatives of the Interstate Commerce Commission during 1929, the number resulting from defective switches outnumbered those due to failures of rail. While not minimizing the importance of continued close study of rails and their failures, this comparison points to the necessity for added attention to turnouts and to their maintenance.

Vast improvement has been made in the design of switch layouts in recent years, largely through the co-operative work of the Track committee of the American Railway Engineering Association and the Manganese Track Society. As a result, the construction of switches today is vastly more rigid and more positive in action than in those of a decade or two ago. Yet, by reason of the break in the continuity of the track structure that is inevitable at a turnout, it still constitutes the weak point in the track. For this reason, it requires special attention in maintenance to see that all parts are in proper adjustment, that they function properly and that wear or deterioration is detected and remedied promptly.

The number of accidents resulting from defective switches is so small as to demonstrate a generally high standard of maintenance. Yet in 1929 a total of 17 persons were killed and 102 injured in those derailments due to defective switches that were investigated by the commission, as compared with 11 killed and 60 injured in similar accidents due to rail failures.

Such a record constitutes a warning to every track foreman and supervisor, particularly since these accidents have almost invariably revealed defective maintenance practices rather than shortcomings in design. It demonstrates the necessity for the inspection of switches with sufficient regularity, frequency and thoroughness to insure the detection of any worn or defective part promptly. Such inspection cannot be permitted to become a mere matter of routine. Rather, it must be so searching as to insure that no defective condition is permitted to develop in an obscure location or elsewhere. It is only through the most constant and thorough maintenance of switches that accidents chargeable to them can be eliminated. Every accident of this character is one too many and constitutes a reflection on the maintenance of way department. The record of last year indicates that track men should increase their attention to this detail of their work.

What The Railways Do In a Single Hour

They earn $716,840 from their transportation operations.

They spend $514,386 in operating expenses.

They pay $330,612 in wages.

They pay $45,288 in taxes to national, state and local governments.

They pick up 6,026 cars that have been loaded with revenue freight.

They take on board 88,932 passengers.

Highway Crossing Accidents

IN NO respect have the railways made a more outstanding record in recent years than in the reduction in accidents. In every classification except one they have effected a marked decrease in casualties. This exception is that group of accidents occurring at highway crossings. Here the casualties are still increasing.

It is true that at highway crossings the railways are not in sole control of activities. It is true also that a large percentage of the accidents at these points are the result of such gross carelessness on the part of the highway users as to make ineffective any protective measures which the railways might reasonably be expected to take, as is evidenced by the number of motorists who drive into the side of trains. However, the prevalence of this carelessness on the part of the highway-using public should not allow railway men to relax in those precautions which rightfully rest with them. It is only when they have placed their crossings in such condition and have surrounded them with such protection as can reasonably be expected, that they can rightfully shift the responsibility for accidents at such locations to others. It does not require much of a survey to show that, as a whole, the railways still have a long way to go in the conditioning of their highway crossings before they can "pass the buck" entirely to the highway user.

These shortcomings are evident in several respects. In many instances corrective measures are relatively simple and inexpensive and the fact that they have not been taken is more an evidence of neglect than of considerations of economy.

One of the first essentials to safety in crossing construction is that the view at the crossing shall not be obstructed. Yet on a recent journey of less

than one hundred miles on one of our most important national highways, which crosses the double-track main line of a high-speed railway at grade at two points, the view was seriously obstructed at each of these locations by small commercial coal sheds erected on the right of way close to the highway line, although these sheds could readily have been built a sufficient distance back from the highway crossing to have eliminated the obstruction to the view. The location of such structures is under the control of the railways and responsibility for their location rests on their managements. This condition is not local to the crossings mentioned but is duplicated thousands of times throughout the country. It is a heritage of the horse and wagon days which constitutes an unnecessary hazard to modern highway traffic.

Even more generally open to criticism is the condition of the crossings themselves. Not infrequently the approach grade is so steep and so close to the track as to threaten the stalling of the car on the crossing. More commonly, the surface near and between the tracks is so inferior to that on the highway itself as to force the driver to slow down quickly and with little warning. Again, many times the highway is narrowed abruptly at the crossing, forcing a driver to change his direction of travel. Not infrequently the existence of the crossing itself is so inadequately marked by approach signs that a driver comes upon it unexpectedly. None of these conditions may be sufficiently aggravated to be inherently dangerous in itself, but they are sufficient to require the attention of a driver at a time when he should be free to observe the condition of the railway tracks. No small proportion of the grade crossing accidents that are commonly charged to carelessness are due to the diversion of a driver's attention from the railway at a critical moment.

This is a condition which warrants more study by railway officers and particularly by those responsible for the maintenance of these crossings. To insure that the conditions are properly understood, every crossing should be examined by these officers from the highway point of view, preferably from an automobile, for it is only in this way that the problem and the attitude of mind of the motorist can be appreciated. Only when the problem is approached in this way can the needs be appreciated and proper measures adopted. It is only after the railways have brought their crossings to such a plane of maintenance that they can pass the responsibility for accidents unreservedly on to the highway users. Since highway crossings come under the jurisdiction of maintenance of way officers the solution of this problem rests on them.

Maximum and Minimum Runoff

THE development of water supplies by means of impounding reservoirs calls for the exercise of something more than judgment based on experience, although the intelligent use of facts representing accumulated experience is of prime importance. A reservoir with its attendant accessories costs money and an officer of water supply who undertakes the development of a particular supply is staking his reputation on his conclusions with respect to minimum and maximum runoff. Thus in the design of the spillway for the Galesburg reservoir of the Santa Fe, described on page 372, the waterway cross section provided is considerably greater than that ordinarily considered adequate for an equivalent drainage area in the same territory because calculations of discharge based on a recent flood indicated an extraordinary rate of runoff.

It is, however, the other horn of the dilemma that has confronted most water service men during the present summer. Minimum discharge rather than maximum flow is the problem that now causes the greatest concern. But even in considering the relative adequacy of water supplies during the current drought, one wonders what the result would have been if the drought had been coincident with a period of heavy traffic and therefore much greater demand for water than has prevailed this summer. No study of a surface water supply project is complete that does not include a study of rainfall records of the locality over the entire period of years for which they are available.

Efficiency in Laying Rail

MANUFACTURERS early recognized the advantages of mass production in lowered costs, closer supervision of the various operations and a more nearly standardized product of higher quality. In railway maintenance, engineering officers have been slower to adopt the principles of mass production, owing, in part, to the inherent difficulties of applying them to the widely scattered activities of this form of work. On a succeeding page of this issue, a detailed description is given of the methods employed on the Chicago, Milwaukee, St. Paul & Pacific in laying rail with gangs that are organized with the primary object of mass production.

At the beginning of this experiment, it was clearly foreseen that the results would not be satisfactory unless two fundamental principles were kept in view constantly: First, that the work would have to be done to the highest possible standard and, second, that machine equipment must be substituted for hand labor wherever practicable. With these principles in mind, and as the methods of doing the work have been perfected through experience over a period of five years, the output per man hour has been increased 90 per cent, and the costs have decreased 60 per cent.

Some of the important reasons for both the increased production and the decreased costs are found in the constant and intensive supervision that is given to every detail of the work; the flexibility of the gang organization which permits the almost immediate transfer of men from one operation to another as needed; and the studies which have been made to reduce lost motion.

In any form of mass production it is the seconds saved here and there that are most important in the final result, and this principle is no less applicable to the laying of rail than to any other form of production. In fact, the laying of rail presents a particularly fertile field for time studies, and maintenance officers are coming to realize more and more that the heavy annual cost of relaying rail can be reduced substantially by securing a greater output from the same organization.

In the replacing of one rail with another there are numerous interconnected operations that must be performed, and any reduction in the time that is consumed in performing any one of them, no matter how small it may seem to be, is worthy of the most careful consideration. In an ordinary day's work in relaying rail, a large number of individual rails are placed in the track, so that a few seconds clipped from the time required to handle each one is multi-

plied many times by the end of the day, and the aggregate of this saving will be noticeable by the resulting increase in production.

The advent of labor-saving machinery has gone so far toward placing rail-laying gangs on an efficient basis that it is possible that too many railway men are looking to further developments in this direction to increase the efficiency of their gangs. It is reasonable to expect that further developments in such equipment will place the laying of rail on a still higher plane of efficiency. Maintenance officers can do much in the interim, however, to increase the production of their rail gangs by making a careful study of the organization and its methods, paying particular attention to seemingly minor details.

As an example of what can be accomplished by such studies, the Milwaukee, which had followed the practice of hanging the joint bars at the forward ends of the rails prior to installing them in the track, adopted the practice of attaching them at the rear end of the rails instead. This move was found to result in a marked increase in the output of the gang, amounting to approximately a mile of rail in a nine-hour day. Doubtless there are many other ways by which the time of laying a rail can be reduced, but such opportunities can be brought to light only by a careful study of the organization and procedure of the gangs.

Little Streams

THE SIDES of valleys occupied by rivers frequently have the form of a concave curve, with the sides relatively steep near the top and comparatively flat at the bottom. This outline of the hillsides is the result of long years of corrosion and deposition, a process which is gradually flattening out what were once valleys with bold steep sides. Earth, sand and stone dislodged by rain and stream flow were deposited at the bases of the valley walls, forming banks of talus or debris at their bottoms, thereby giving the valley sides the curved contour mentioned above.

Because of the more favorable grades to be had in valleys, railways have been located in them and the flatter slopes at the lower elevations have naturally favored the construction of the railways close to the floors of the valleys rather than high up on the sides. However, by reason of the fact that the geologic action which has given valleys their present form is a continuing one, valley locations have frequently been a source of severe problems for the maintenance officer at the lateral stream crossings, which are especially numerous in such locations.

The ability of a stream to carry suspended matter is a function of its velocity. At high speeds it can carry or roll rocks of considerable size, while at very slow speeds it can support only the finest of alluvial material. Consequently, the stream following a gulley or ravine in the sides of a typical river valley, being steep in its upper reaches, picks up large quantities of material which it must necessarily drop lower down where the slope flattens out and the velocity of the water decreases.

This action becomes manifest along the railway at the foot of the slope by the filling up of the stream beds under bridges or the clogging of culverts. This process, on the whole, is a gradual one, although the severe flow resulting from a single heavy rain may produce serious effects; the net result, however, is a progressive reduction in the areas of the waterways under the railway.

In some cases there has been no choice but to raise the roadbed level as the stream beds fill up, but in some locations, as in those described on page 368 of this issue, such heroic action is being avoided by stream control, chiefly through the construction of dams that produce stretches of slack water where material will be deposited before reaching the railway bridges. A further solution, which has proved effective where the adjoining hills or bluffs are largely rock, is to pave the upper reaches of the streams with heavy rock so as to reduce the erosion and thereby insure that the stream carries a minimum of matter in suspension.

These measures can be carried out in various ways and in different combinations and with a variety of materials. Success lies in a thorough understanding of the principles involved and a careful survey of the individual location before attempting a solution.

Fish Worms and Concrete

ANGLERS for pan fish during the present summer have been confronted with a real problem by reason of the scarcity of worms, the severe drought having dried out the ground to such unusual depths that in many locations digging for worms has become too much of a job to be classed as a sport. But the absence of the normal amount of moisture in the soil is the occasion for concern with respect to more serious matters. Thus, the constructors of concrete highways in some localities have been alarmed at the possibility that the dry soil will draw moisture from the newly placed concrete to an extent that will leave an inadequate amount of water in the mix to effect complete hydration. Sprinkling of the subgrade preliminary to placing the concrete, has, of course, aggravated the problem of limited water supplies.

This experience directs renewed attention to the importance of protecting concrete from the loss of water during the period of hardening. Whether this loss takes place by absorption, as in the rather unusual case cited, or through evaporation from the surface, the result is the same. The concrete will not develop its full strength if the water necessary for chemical action is not present. The problem is not solved by the use of a greater amount of water in mixing, since the excess water not required for hydration serves simply to leave voids in the concrete after it has been drawn out by evaporation or absorption. The only proper procedure is to use only the required amount for mixing and then either protect the concrete from loss of water or compensate for such losses by sprinkling.

The Cleveland Union Terminal

A view up a portion of Obbe's creek, showing one of the dams, the willows which line both sides, and the upper portion of a section of timber cribbing

Little Streams Cause Big on

Corrective measures, including revetments, a series of dams and concrete flumes and the planting of willows result in marked decrease in erosion

IT IS doubtful if many roads have experienced as serious difficulties in protecting their lines against the erosion of lateral streams as the Erie on its main line between Corning and Hornell, N. Y. Between these points it is not only a question of carrying a deluge of water under the tracks from time to time, particularly in the spring and fall, but of greater concern, is the disposal of the tons of rock and debris carried by the water, which block the streams and choke culverts. At times the rock and debris are carried up over the railroad embankment and foul the tracks themselves.

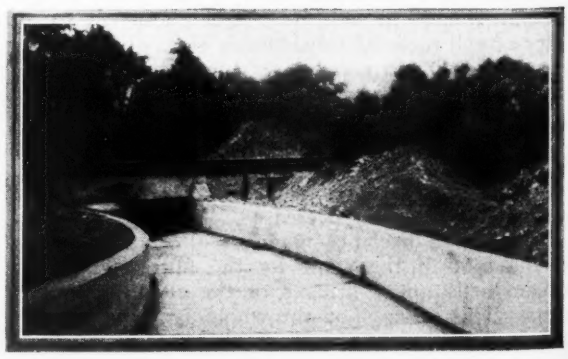
For more than 30 years the Erie has been forced to give special attention to the streams crossing the right-of-way in this territory, but it was not until the last few years that work was started on a large and comprehensive scale to provide permanent relief from the trouble which has been experienced. Possibly the most interesting and effective detail of the methods which have been employed, and which are contemplated in a number of other instances, is the construction of timber dams, as many as 19 of these having been built in a single stream in an effort to produce a non-eroding grade.

Flood Retard Work Has Many Phases

Within the territory between Corning and Hornell, a distance of about 40 miles, the railroad closely parallels the north bank of the Canisteo river in a deep, broad valley which many water courses cross to enter the main river. For the most part these tributary water courses follow irregular channels down the steep side of the valley, and are practically dry except during periods of heavy rainfall. As the drainage areas of most of these streams lie in rocky territory, where run-off is rapid, a few hours of heavy rainfall transform an otherwise dry or tranquil stream into a gouging torrent carrying hundreds of tons of gravel, sand and shale with it to the low lands below. Here, in certain cases, the wash of the streams has been known to block the natural channel and to send the water meandering in numerous new channels, while at other places it has at times so completely choked the waterway provided by the railroad, that the water, still carrying tons of sand and stone, has surged over and down the tracks.

Such a situation requires not only vigilance on the part of the railroad during and following storms, but causes delay to trains, damage to the roadbed and extensive clean-up work at times, as well as constant excavation work within the creek beds themselves to restore their normal channels. At many of the streams, steam-shovel work by the railroad has been so extensive that for hundreds of feet each side of the tracks, the stream beds lie between high embankments of gravel and shale excavated from the stream.

For a long time the problem in these streams has been recognized primarily as one of providing non-eroding grades. In order to do this the Erie adopted a plan of constructing a series of dams in the streams, upstream from the railroad, to impound the debris carried by the water, and thereby flatten out the channels between dams. Supplementing this work,



Looking Down Through the Flume Carrying Obbe's Creek Across the Right-of-Way

Problems the Erie

A Close-up View of One of the Timber Dams in Dean's Creek

which has already been completed in several streams, timber cribbing has been constructed at a number of points in the streams where the banks were subject to severe wash; willows have been planted in the cribbing and along the edges of the streams to minimize the amount of wash, and in several cases, the alinement of the streams has been straightened to give the water a more direct route to the Canisteo

Looking Down Toward the Railroad in Steven's Creek. Showing Character of the Bed and High Banks of Excavated Material Along Sides

river. At several points also, waterways have been enlarged and concrete flumes have been constructed under the tracks to speed-up the flow of the water and thereby minimize the tendency of material to deposit on the right-of-way.

Brown's Creek Exhibits Typical Characteristics

In correcting conditions in a stream called Brown's creek, just east of Adrian, N. Y., all of the important measures adopted by the Erie for small stream flood control have been employed. The work in this stream involved the construction of 16 timber dams, about 450 ft. of timber crib bank revetment, a concrete flume across the right-of-way, and the planting of a large number of willows.

To the casual observer, Brown's creek, under normal conditions, would appear to be a peaceful hillside watercourse. It is narrow and only a few miles long, and its drainage area includes only about 1½ sq. mi. A study of the creek, however, is sufficient to convince one of its potential destructive force, even if evidence of this were not apparent throughout its lower region. In the first place the general character of the hillside is rocky, overlaid at most points by a relatively shallow layer of earth and vegetation. The creek itself extends through a shale bed, and flows toward the railroad at right angles in an unusually straight course. Of most importance from the standpoint of its destructive action, however, is its steep grade, which, for about 2,700 ft. upstream from the right-of-way, has an average fall of about 6.2 ft. per 100 ft.

As a result of this combination of natural conditions, heavy, sudden or prolonged rainfall over the Canisteo valley invariably transforms this otherwise comparatively dry watercourse into a torrential stream. With the water comes tons of shale, gravel and earth, blocking the lower channel, piling up on the right-of-way, clogging the concrete slab underpass under the roadway, and at times, surging up over the tracks. When this latter condition occurred it not only presented a hazard to the safety of train operation and interrupted traffic, but it left a washed roadbed covered for several hundred feet with a deep layer of broken rock and gravel.

The first step taken to correct this situation in recent years was to enlarge the opening under the tracks and to construct a concrete flume across the right-of-way, to speed up the movement of the water across the railroad property and thereby prevent the deposit of material. This improved conditions but was recognized as only the first step in a plan for securing permanent relief, which, it was apparent, involved flow-retard work upstream.

To retard the flow of water during freshets, it was planned to install timber dams across the stream, at such intervals as to produce a generally non-eroding grade. There was no intention of impounding the water at these dams, but rather, to arrest the movement of the rock to the height of each dam, and thereby build up a series of flattened grades and waterfalls.

To achieve the desired results in Brown's creek required the construction of 16 dams. Depending upon the fall of the stream bed, these were made from 3 to 5 ft. high and were located from 50 to 275 ft. apart, upstream from the railroad. The farthest dam is about 1,900 ft. from the railroad. This arrangement promised a two-per cent grade in the stream bed, which it was felt would be sufficient to minimize erosion.

The dams themselves are generally more or less rustic structures, constructed from trees cut in the

immediate vicinity by bridge and building forces of the road. Essentially, they consist of a series of anchor posts placed across the stream, at right angles to the direction of flow, suitably fastened upstream by tie logs and made to support a dam facing of saplings. Specifications for the dams call for anchor posts nine inches in diameter at the top and six inches at the bottom. These posts are driven or dug into the stream bed to a depth of five feet, more or less, depending upon the height of the dams, in pairs, the various pairs being spaced four feet apart across the stream. The posts in each pair are placed nine inches apart in the direction of flow, providing a space between which is filled with saplings laid lengthwise across the creek. The outer ends of the saplings at each end of the dam are sunk deep into the side banks. The saplings range from about three inches to nine inches in diameter and as many lengths are used as are necessary to cross the creek.

Dams Are Solidly Built

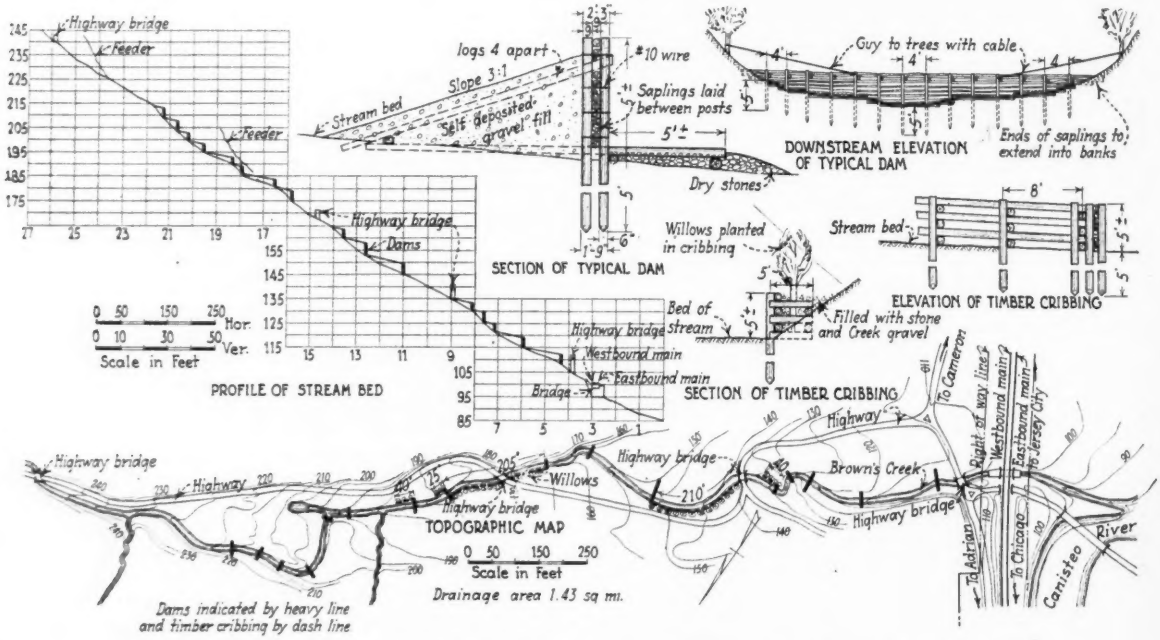
Care is exercised in the construction of the dams, but primarily from the standpoint of giving them strength. All logs are spiked together at intersections, and when the cross saplings have been placed, the tops of the two anchor posts in each pair are tied together securely by No. 10 wire. No attempt is made to make the dams waterproof; in fact, that is not desired, their sole purpose being to retain the broken rock and gravel which is carried down by the water, and thereby eventually raise the level of the creek bed above each dam. In some cases it has been found advisable to do some backfilling back of dams to prevent scour.

from the anchor posts at about the one-third points in the widths of the dams to trees along the banks. In some of the projects for larger streams now being considered, dams of second-hand bridge timber are proposed, using larger posts and timber instead of saplings, on account of the size of the structures.

As a further precaution against scour of the creek bed immediately up or downstream from the dams, but more particularly on the lower side, and at the same time to assist in preventing their overturning, each of the dams is provided with an apron of logs placed closely together. The logs used in these aprons vary in size but are at least 18 ft. long. The downstream end of the apron is usually made at least five feet long, while the upstream end extends back to the base of the tie logs. Spiking logs, to hold the units of the apron together, are placed under the downstream end, near the end, and close to the anchor posts. The space between the apron on the downstream end and the sloping bed of the creek beneath it is packed with dry stones. On the upstream end there is only one spiking log and this extends across the top face of the apron at the intersection of the dam tie-logs with the apron. This provides a means for a spiked or bolted anchor for each tie log, and, therefore, when the apron is weighed down with stone, there is no possibility of the dam overturning.

Cribbing and Willows Are Used Extensively

In addition to the work in Brown's creek, similar flood retard treatment has been completed in four other creeks, Gorton's, Obbe's, Dean's and Crosby creeks, and work is considered or under way on at



Situation at Brown's Creek, Showing Remedial Measures Employed and Details of Structures

In order to give the dams stability and to enable them to withstand the first onrushes of water and stone, tie-logs are provided at each pair of anchor posts, which extend from near the tops of the posts to anchorages in the creek bed upstream. For this same purpose, the wider dams are guyed upstream by strands of scrap cable, the guys usually extending

least six others. While the dams form the principal feature in retarding the flow and wash in these creeks, a considerable amount of timber cribbing has been built along the banks of the creeks where the work is already completed, and considerable more of this type of bank protection is planned in work still to be undertaken.

The cribbing used is of a more or less common type of construction, with face posts sunk into the creek bed and with a series of headers and stretchers, the headers being extended back and buried in the bank. After a section of cribbing is completed, it is filled with stone and creek gravel to hold it in place.

Plant Willows

To assist in solidifying the backfill in the cribbing, particularly at places where the wash is unusually severe, willow trees were planted in the top at intervals of about six feet. The roots of these trees not only work their way downward through the backfill and anchor into the creek bed, but also extend sidewise into the bank where they take a firm hold. Several thousand trees have also been planted directly along the banks where no cribbing is provided, and also in the creek bed itself, and have proved most effective, both in the action of the roots in holding the creek bed intact, and in the flow retard action of the branches and foliage during high water.

For this purpose white willow is used, both because of its heavy fibrous roots, which are often two-thirds as great in extent as its branches and foliage, and because of its hardy nature and ability to grow in poor soil. Planting of the willows has proved so effective in the work thus far that other extensive plantings are contemplated in the work still to be done.

The willows are usually set out during the spring just after the frost is out of the ground and before the sap begins to run. The individual set-outs are healthy shoots cut from trees which have already established themselves, the shoots being from three to four feet long and having stalks from ½ in. to ¾ in. in diameter.

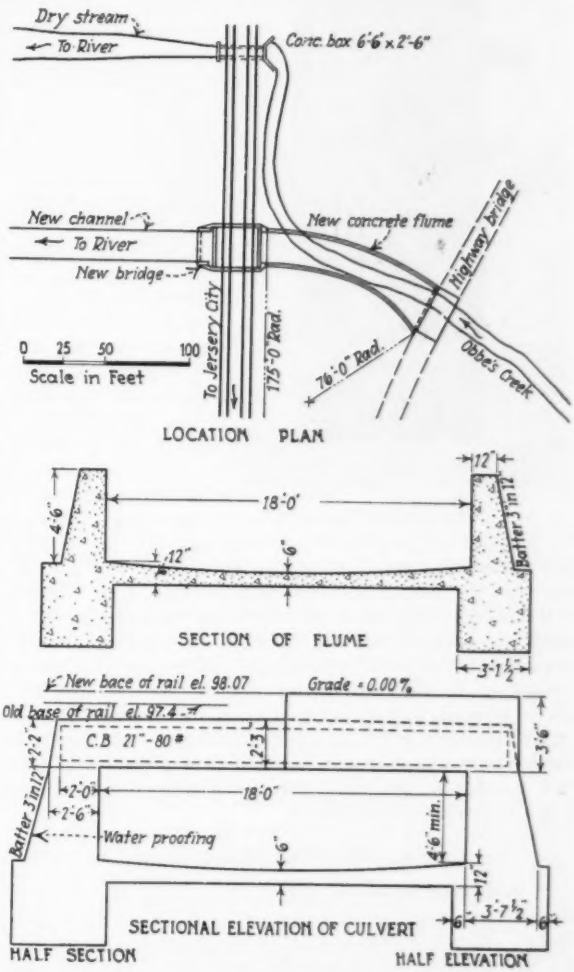
Planting of the willows consists merely of the driving of a steel bar into the ground or loose rock to a depth of two or three feet and inserting the shoot. With no more careful planting than this, about 80 per cent of the willows set out by the Erie have taken hold and grown. Under average conditions of soil the trees grow about ten feet in height a year, but at most places they are kept pruned back to 15 or 20 ft. in height so as to stimulate the growth of their roots.

Concrete Flumes Assist Flow

In a further effort to improve the conditions in certain of the creeks, the channels have been straightened and given a more direct flow to the right-of-way, openings under the tracks have been enlarged, and, at several points, concrete flumes have been constructed, or are planned, leading directly into the opening under the tracks, and extending either upstream or both ways from the opening. At Obbe's creek, where one of these flumes was constructed in connection with a change in the alinement of the creek and where a concrete slab bridge was built over the new waterway, the flume extends the full length of the bridge abutments under the tracks and for about 107 ft. upstream to an opening under a highway bridge.

Directly under the roadbed, this flume is formed by the abutments, and by a concrete pavement in the stream bed, which is sloped downstream on a two per cent grade. Above the bridge opening, which is 18 ft. wide, the flume is formed by two concrete side walls, carried down to a suitable foundation, and a concrete slab floor, 4 ft. 6 in. below the tops of the walls. This section of the flume is on an easy curve to conform with the new alinement of the creek, has an 8.5 per cent grade, and is the same width as the bridge opening, except at its upper end where it is widened out to 30 ft., the width of the highway opening. Details of the flume construction are shown in the accompanying sketch, which also includes a location plan.

Through these various methods the Erie plans to correct the adverse creek conditions between Corning and Hornell. That it will succeed is evidenced by the improved conditions which now exist in those creeks where the work has been completed. All of the flood control work is being carried out under the general direction of J. C. Patterson, chief engineer maintenance of way of the Erie, and I. H. Schram, engineer maintenance of way, at Hornell, except in the case of two or three of the larger creeks, where, because of the magnitude of the work required, it is being handled by the engineering department under G. S. Fanning, chief engineer. All of the work being handled by the maintenance department is being done by the division bridge and building forces under B. Blowers, division engineer.

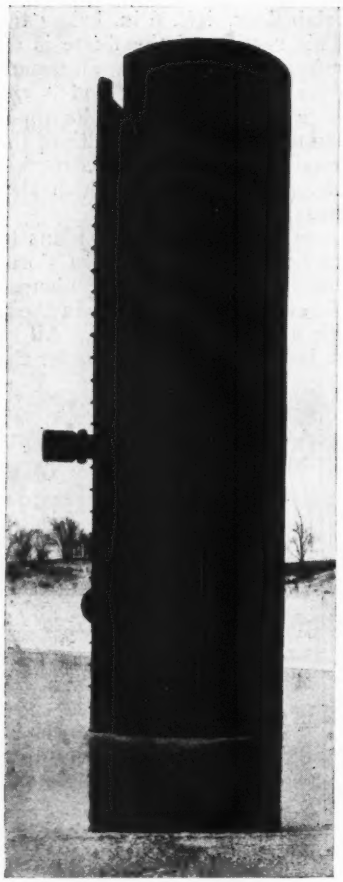


Plan and Details of Flume Carrying Obbe's Creek Across the Right-of-Way

Top—General layout plan of creek change and new concrete flume Center—A section through the flume. Bottom—Half section and half elevation of new waterway showing paved stream bed

Reservoir Replaces Well at Galesburg

By A. W. JOHNSON
Supervisor of Water Service, Atchison, Topeka & Santa Fe, Topeka, Kan.



The Intake Tower

THE completion of a 675 million-gallon reservoir by the Atchison, Topeka & Santa Fe near Galesburg, Ill., not only insures a greatly increased supply for the water station at that place, but also provides water of better quality. Prior to the completion of the new reservoir, the railway secured its water for locomotive use from a dug well, 20 ft. in diameter by 75 ft. deep, located within the city limits, but the stopping of long trains for water near this well was objectionable because it entailed the blocking of several street crossings. However, the main objection to the well-water supply was its quality. Even though subjected to treatment, so much difficulty was experienced by enginemen in handling heavy trains that it was decided that a reservoir supply would be the only means of overcoming these train operating difficulties.

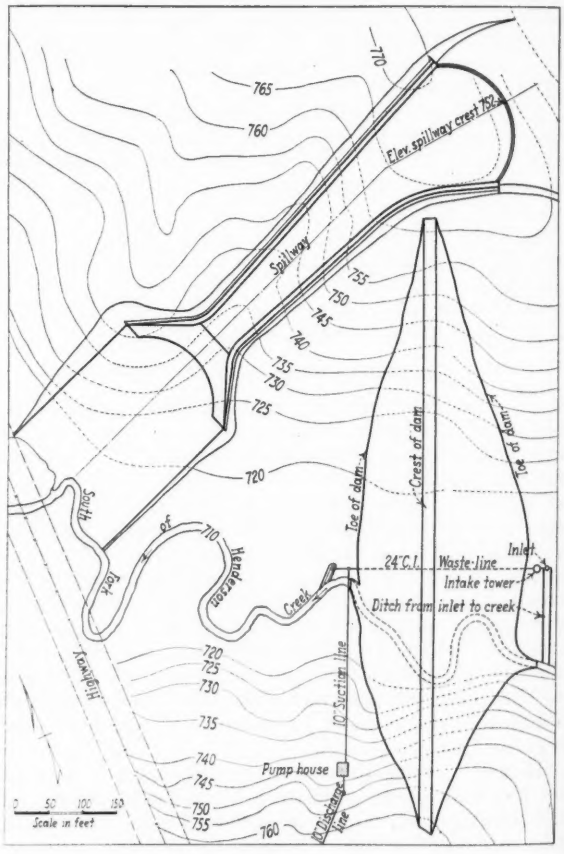
Select Site Four Miles Away

A reservoir site was selected on Henderson creek about two miles west and four miles north of Galesburg. The drainage area at this point measures 8½ sq. mi. divided about equally between grass and cultivated land. Just prior to making plans for the reservoir at this location, measurements of the discharge of a heavy flood indicated a runoff of approximately 1,000 sec. ft. per sq. mi. which is somewhat more than is ordinarily provided for in reservoir spillway designs in this territory. However, the spillway finally settled on was designed to meet this extreme condition. The water depth at the dam below spillway level is approximately 40 ft. and the reservoir when filled covers approximately 145 acres.

The dam is of earth-type construction, 870 ft. long by 18 ft. wide at the crown, and has a total height above creek bed of 50 ft. with slopes of 3 to 1 on the upstream side and 2 to 1 on the downstream side. The water side is protected with 12-in. stone rip rap placed on a 6-in. cushion of pea gravel. A reinforced concrete corewall 12 in. thick resting on a 24-in. concrete footing was built into the dam simultaneously with the earth fill and a water-puddled clay core about five feet thick was placed on each side.

A Concrete-Lined Spillway

The spillway is of reinforced concrete construction 550 ft. long and trapezoidal in section, the side slopes being laid on a 1 to 1 slope with a vertical height above spillway channel of seven feet. The channel is



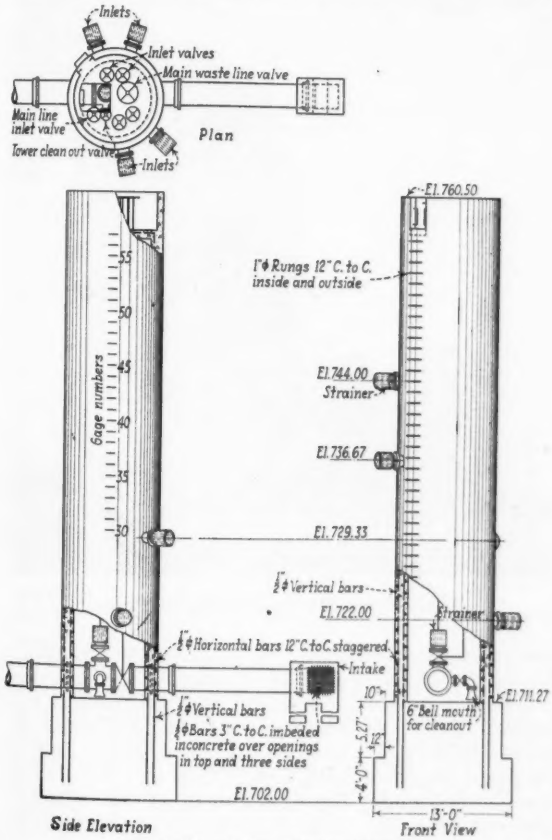
Map of the Dam and Spillway Site

Santa Fe obtains water of better quality by impounding surface supplies—Pumps under remote control

Airplane View of the Reservoir

laid on a six-per cent grade with a vertical drop of seven feet at the lower end into a cushion box designed to dispel the high velocity and permit the water to flow to a highway bridge a short distance below at no increase over the original natural flow. The spillway, which is 240 ft. wide along the crest of the ogee entrance weir, tapers to a width of 50 ft. just above the cushion box and increases to a width of 240 ft. at the discharge.

The intake tower is of reinforced concrete and has a 7-ft. inside diameter and walls 14 in. thick. Eight feet below spillway level there is a 12-in. inlet pipe equipped with a strainer and a valve and below this at approximately seven-foot intervals there are three similar inlets. A 24-in. cast iron pipe is laid under the dam from the intake tower to a point well beyond the toe of the downstream embankment slope. This serves as a drain for the reservoir and also as part of the suction line to the pumps, there being valves at both ends of this line. A 10-in. cast iron pipe connects into this 24-in. line approximately at the bottom of the lower embankment slope and extends for 275 ft. parallel with the center line of the dam to the pump pit, the floor of which is at an elevation 22 ft. above the creek bed. The pump house consists of a concrete pit 14 ft. deep, measuring 13 ft. wide and 18 ft. long inside, and having a brick superstructure and a timber subfloor below the frost line to protect the pumps against freezing and permitting operation by remote control.

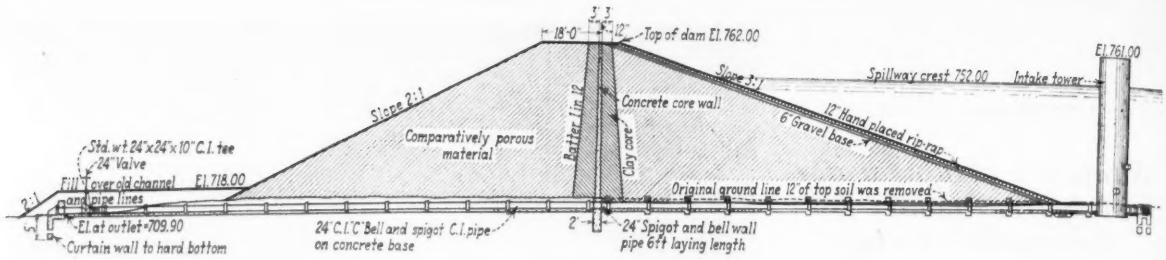


Details of the Intake Tower

Remote-Control Operation

The pump house is equipped with two centrifugal pumps, each with a capacity of 500 g.p.m. and driven by 40-hp. electric motors. They are started and stopped by remote push-button control from the coal chute two miles west of Galesburg, where a new water station was established. This station is approximately four miles from the pump house. The pumps work against a static head of 75 ft. plus a friction head of 70 ft. resulting from the flow through the 10-in. discharge line. The operation of the pumps by remote control has proved very satisfactory. No pumper or attendant is employed at the reservoir, but water service men from division headquarters inspect the pumps once every two weeks to be sure they are operating satisfactorily. All pumping units are ball bearing and need lubrication not oftener than once every three months.

In designing the pump pit it was believed that pumping equipment and water piping in a pit 14 ft. deep would not freeze. However, experience during the first cold weather indicated that additional pro-



Cross-Section of the Dam

tection against freezing would be necessary. Consequently, the lower part of the pit below ground frost line was covered with timber and insulating board which are kept in place in cold weather and opened during the summer months.

The New Service Facilities

The discharge pipe line from the pump house to the water tanks at the Santa Fe tracks consists of approximately 20,000 ft. of 10-in. Class C cast iron pipe. The storage is provided by two 24-ft. by 60-ft. standpipe tanks, both of which had been moved from the old water plant at Galesburg. At present both tanks are used for storage purposes, but one of them is equipped for treating water in case this becomes necessary. Samples of reservoir water are analyzed from time to time to note the change in the quality. The table shows the changes in the content of dissolved solids that have taken place since the reservoir was completed on July 18, 1929. So far, enginemen report good locomotive performance with the use of this water without treatment. However, the question as to whether or not it should be treated is being carefully watched and analyzed.

Grains per U. S. Gallon

	July 23, 1929	Nov. 11, 1929	Dec. 11, 1929	Jan. 25, 1930	April 4, 1930
Calcium sulphate	0.6	0.8	2.0	trace	1.9
Magnesium sulphate	2.1	4.5	5.9	9.5	5.1
Calcium and magnesium chlorides	.....	.....	.....	.....	.....
Calcium carbonate	5.0	7.5	7.5	10.7	7.1
Magnesium carbonate	1.9	2.8	1.9	2.3	2.4
Soluble Incrustants	9.6	15.6	17.3	22.5	16.5
Sodium chloride	0.4	0.7	0.8	0.6	1.2
Sodium sulphate	2.4	.....	0.3	.....	.....
Sodium carbonate	.....	.....	.....	.....	.....
Soluble Solids	12.4	16.3	18.4	23.1	17.7
Alkalinity	8.2	12.4	9.2	14.7	10.7
Suspended matter	trace	trace	trace	.....	trace

The water tanks are located approximately 300 ft. from a 500-ton concrete coaling station where there are two 12-in water columns from which westbound and eastbound engines can take water and coal at the same time. The pipe line from the tanks to the water columns is 16-in. Class D cast iron.

A comparison of the cost of producing water with the new plant with that incurred in pumping water from the old well by steam indicates a considerable saving as shown by the following statement which does not include overhead and investment charges. The statement also shows that when water of good quality was to be had at Galesburg more water was taken, thereby reducing the demand for water at the stations both east and west of this location.

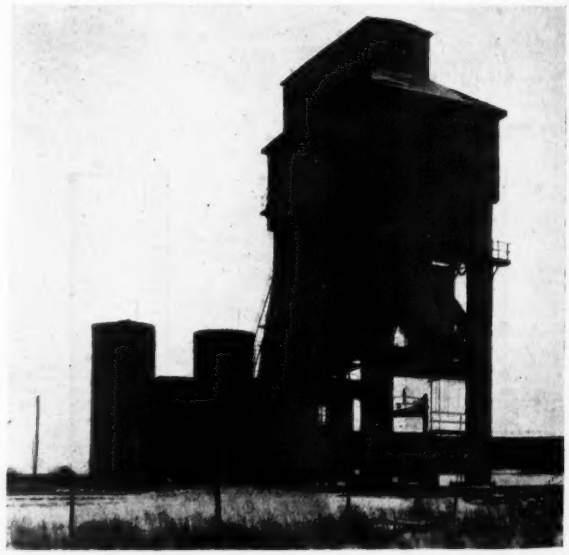
Monthly Water Usage and Cost for the Year Prior to Placing the Reservoir in Service on July 18, 1929
Average for One Month

Production	Cost	Cost per 1,000 Gal.
2,696,666 gal.	$279.64	$0.104
Treating cost	.....	0.092
Total per 1,000 gal.	.....	0.196

Monthly Water Usage and Cost for the Year Subsequent to Placing the Reservoir in Service
Average for One Month

Production	Cost	Cost per 1,000 Gal.
3,875,666 gal.	$177.56	$0.046
Not treated	.....	0.000
Total per 1,000 gal.	.....	0.046

In connection with building the Galesburg reservoir, it was necessary for the railway to build 1½ miles of new road and improve ½ mile of private road to the state highway department's standard and also make two minor road changes in order to secure the closure of one cross road flooded by the reservoir.



The Coaling Station and Water Tanks

The field work in connection with this project was handled under the direction of T. H. McKibben, division engineer, Chillicothe, Ill. The preparation of the plans, together with supervision of construction, was handled under the direction of H. W. Wagner, chief engineer, W. A. Guild, assistant chief engineer, and the writer.

Culverts Are Siphons on This Branch Line

A GRADE line lower than the high-water level at culverts, a concrete gateway through a dike 20 ft. high, 57 corrugated iron pipe culverts aggregating 2,100 ft. in length, and grading averaging only about 6,200 cu. yd. a mile, are the most important features of construction of a novel 14-mile branch line which the Southern Pacific recently completed in California.

This line was constructed to meet the transportation requirements of the River Farms Company of California and adjacent fruit and grain lands. The River Farms comprise a strip of reclaimed marsh land averaging about 2½ miles in width and extending along the west side of the Sacramento river from Knights Landing, Cal., north about 20 miles. This land has been brought to a high state of agricultural development by an extensive system of dikes and irrigation and drainage ditches. It is protected from the river during the flood season by dikes, with sec-

A View of the Concrete Gateway Through One of the Second-Line Dikes

ond line protection by a series of cross dikes which prevent the general flooding of the territory in the event of the failure of the main dike. Also, owing to the fact that crops are rotated in this region, additional dikes are required to confine the irrigation water to restricted areas in which rice is cultivated.

The new line extends from a connection with the Woodland-Marysville branch of the S. P. at Knights Landing, on the Sacramento river, north about 14 miles to Boyers Landing, also on the river. An unusual condition arose from the fact that the irrigation ditches in this territory are constructed in such a manner that the surface of the water is normally higher than the surrounding territory, and in order to avoid high embankments the grade line of the track was constructed on a level lower than that of the high water in the ditches and this water was then siphoned under the track. All of the smaller openings consist of Armco corrugated iron pipe, some as large as 48 in. in diameter.

The headwalls and wingwalls of these openings are designed to provide a free board of 1½ ft. above the high-water level in the ditches and they are, therefore, somewhat higher than the track. The soil which was available for grading is of such a character that it cannot be maintained in an embankment which is partially submerged and for this reason it was necessary to design the end walls so as to cover the entire cross section of the stream. These walls are constructed of plain concrete and the details of the design were, of course, altered to suit the conditions obtaining at the particular location.

One of the culverts was equipped with a Calco slide gate in order that the flow of water in the ditch could be regulated at will. This gate consists of a metal diaphragm covering the inlet to the culvert, which slides vertically on a frame and is raised and lowered from the top of the headwall by means of a wheel on the end of a long shaft. In addition to the

The Headwalls of the Culverts are Higher than the Grade Line of the Track

pipe culverts, four creosoted pile bridges totaling 525 ft. in length were installed on the line for crossing the larger channels. The grading on this line was extremely small, amounting only to 87,000 cu. yd.

The dike in which the concrete gateway was constructed is one of the second-line dikes which were mentioned above and, of course, is of service only in case of a break in the main river dike. Rather than carry the track over the dike by means of a costly fill, it was decided to construct a gateway through it that could be bulkheaded quickly in the event of a break in the main dike. The design of gateway ultimately adopted consists of two U-type abutments of plain concrete, 18 ft. apart and connected by a low wall, also of plain concrete, over which the rails were laid. Notable among the features of this gateway is the entire absence of reinforcing in the concrete in any form.

The construction of the line was commenced early in the spring of 1929 and, since it was necessary to provide transportation for fresh fruit early in the season, the work was rushed and the line was turned over for operation 85 days after the grading was commenced. The project was carried out under the general direction of G. W. Boschke, chief engineer, to whom we are indebted for the information appearing in this article, and the field work was in charge of A. E. McKennett, construction division engineer.

A NEAR-EAST CONTROVERSY.—Although all interested parties are generally agreed, acording to Department of Commerce reports, that the government of Irak, as at present constituted, might well own and operate its own railways, final settlement of the question has been delayed because no agreement has been reached concerning the price which the Irak government should pay to Great Britain for the lines, equipment and rolling stock built and installed as war measures by the British Army of Occupation, and still owned by the British government. The inability of the two governments to agree is delaying the commercial progress of Irak.

How to Secure
Efficient Operation
From a Motor Car

A discussion of those practices that will reduce the cost of running and prolong the life*†

By C. R. KNOWLES‡

THE modern roadway motor car is not a complicated machine and its operation does not call for any unusual mechanical skill. At the same time, if a car is to render efficient service it must be given the same intelligent care in operation that is necessary with any piece of machinery. Motor cars are frequently subjected to abuses in service that not only reduce their efficiency but increase the expense for repairs and shorten their life.

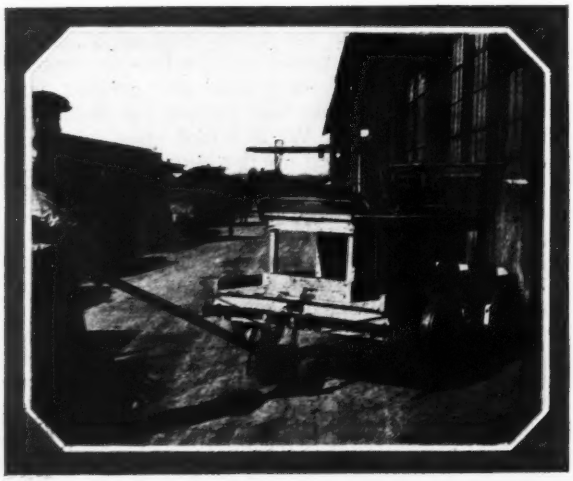
The average annual expense of maintenance of a roadway motor car equals from 25 to 30 per cent of its first cost. This is a reflection on present methods of operation. As a rule, railway expenses are watched very closely, and carelessness that results in loss or damage to property in amounts as small as $5 or $10 generally calls for criticism. Motor cars appear to be an exception to the rule, however, as the careless operation of a motor car that causes an unnecessary expense of from $100 to $150 is not at all unusual and is apparently accepted without question in many cases.

A roadway motor car should have a life of from eight to ten years, while the periods between shopping should vary from two to four years, depending upon the service required of it. Instances are not at all uncommon where cars have been in use for five years without being shopped, and a number of cases have been reported where cars have been in use for as long as nine and ten years without general repairs. The fact that these cars give long years of uninterrupted service without extensive repairs is not a matter of chance. It is the result of careful, intelligent operation. It is hardly to be expected that every car can be operated for eight or ten years, or even five years, without general repairs, but there is certainly room for improvement in the methods of operation of most motor cars.

If the Gasoline Tank Is Refilled at the End of the Day's Work the Car Will Be Ready for Emergency Use

* This is the eighth of a series of 12 or more articles on the Care and Operation of Motor Cars, the first of which, on the Place of the Motor Car in Railway Work, appeared in the January issue, page 5, the second on the type of Motor Car, in the February issue, page 54, the third, on the Motor Car Engine, in the April issue, page 158, the fourth, on How a Motor Car Is Built, in the May issue, page 214, the fifth, on Proper Lubrication, in the June issue, page 248, the sixth, on Ignition, in the July issue, page 295, and the seventh, on the Care of Motor Cars, in the August issue, page 339.

‡ Mr. Knowles is in charge of the operation and maintenance of motor cars and other gasoline-operated work equipment on the Illinois Central System.

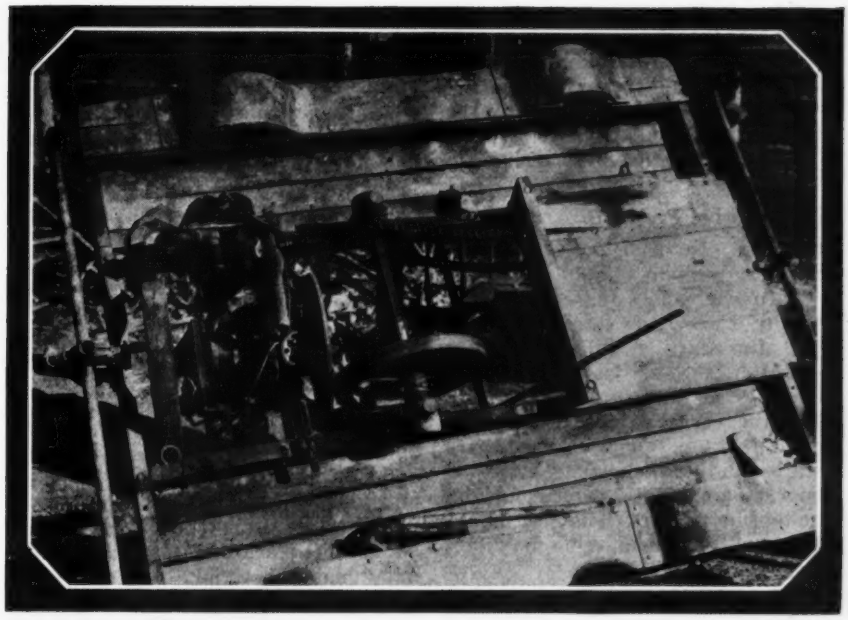


Good Operation Keeps the Car Out of the Shop

Operation of the Car

The first requirement in the efficient operation of a motor car is that it shall be in charge of a competent employee. He should be thoroughly familiar with its proper operation and responsible for its condition at all times. Other employees should not be allowed to operate the car if it is possible to avoid it. The indiscriminate operation of a motor car by different men without regard to their ability or knowledge of the car invariably results in poor operation and increased cost of maintenance. Where a car is used by a gang it is, of course, preferable that the foreman operate the car, but in any event it should be his duty to see that the car is not abused and that the regulations regarding its operation are adhered to strictly from the dual standpoints of efficiency and safety.

Modern motor cars are designed and built to give satisfactory, continuous service. Whether they do or not depends very largely upon the operator and the



This Car Was Wrecked by Racing the Engine

care the car receives. Regardless of the type or make of car, its usefulness and durability and the satisfaction and economy derived from its use can be increased by giving it proper care and attention. The proper care of a motor car includes not only the prevention of abuses to the car resulting from rough handling, as in placing it on and off the track, but also such details as proper lubrication, keeping bolts and nuts tight, the adjustment of certain parts, minor repairs, careful operation and the protection of the car when not in use.

Never Race the Engine

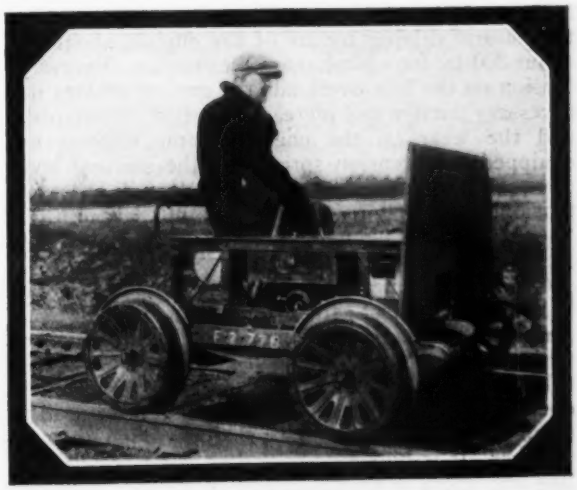
It is the practice of many operators to race the engine on a car of the free-running type to warm it up. This is an extremely bad practice that has ruined more engines than have ever been worn out in actual service. When engines are allowed to race they may be running more than double the rate of speed for which they are designed. This causes excessive bearing pressure and abnormal strains, with resultant failures. The racing of engines also increases the fuel and oil consumption and the wearing of parts and shortens the life of the engine. Excessive speed of operation of the car should be avoided, not only because it is unsafe but also for the reason that it causes excessive vibration and loosens bolts, which causes the parts to get out of line, and in turn leads to a generally unsatisfactory condition of operation and increased cost of maintenance.

The complete wrecking of engines is not at all uncommon and is nearly always caused by the connecting rod becoming disconnected, owing either to loose bolts or to worn bearings. Almost all accidents of this kind can be prevented if proper care is exercised, as the engine will always give notice by knocking before wrecking itself. If the car does not sound or act right, the trouble should be investigated at once as this will often prevent serious damage and delay and frequently an accident that may result in personal injury.

Cooling systems of motor-car engines require little care, as a rule. This is particularly true of air-cooled engines as the cooling effect is dependent upon maintaining a free circulation of air about the cylinder. The cooling systems on water-cooled engines must be kept supplied with the required amount of water. Where the cooling system is not of the anti-frost type, the necessary precautions must be taken to prevent freezing in cold weather. It is a good practice to drain the system whenever possible. Where this is impractical, an anti-freezing solution may be used. A solution of one quart of denatured alcohol to four quarts of water will prevent freezing at a temperature of 15 deg. F. above zero; two quarts of alcohol to the gallon of water will prevent freezing at 10 deg. F. below zero.

Freezing Mixtures

Freezing Temperature in Degrees Fahrenheit	Amount of Alcohol to Add to Each Gallon of Water
20	2 pints
0	4 pints
—20	6 pints
—40	10 pints
—60	19 pints



Careful Operation Eliminates Winter Troubles

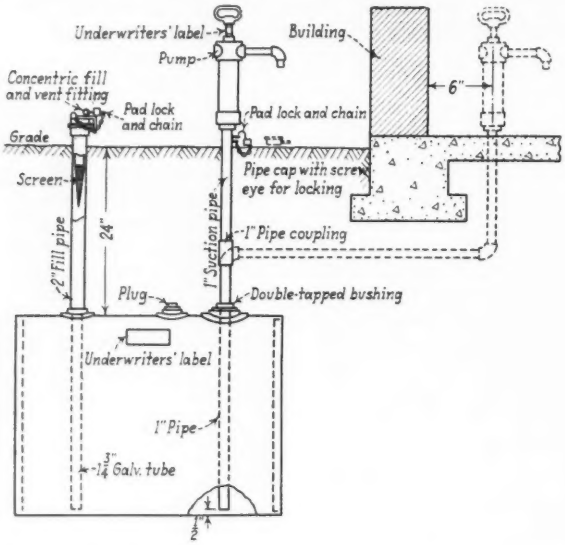
Additional alcohol must be added from time to time to make good the loss through evaporation.

Proper care should always be exercised in throwing the load on engines when starting cars with free running engines. Never race the engine and throw the load on suddenly with any type of drive as this throws excessive strains on the driving mechanism and engine.

Avoid Excessive Pressure

The pressure on friction disc drives should be just sufficient to drive the car without slipping. Greater pressure causes loss of power and excessive wear on bearings. More pressure is necessary in starting than in maintaining speed after starting and the pressure should be reduced after the car is under way. Clutches should always be placed in gear carefully to avoid strains due to the car starting with a jerk. Where variable speed transmissions are used, cars should always be started in first or low speed.

Where belt-driven cars are in use, care should be used in applying the tension to belts. The belt should be just tight enough to pull the load. One manufac-



Underground Storage of Gasoline Prevents Fires and Waste

turer states that the maximum combined tension on both the tight and loose side of the belt, and including the natural driving torque of the engine, should be about 300 lb. for a six-horsepower engine. Excessive tension on the belt overloads the engine, creates unnecessary friction and increases the fuel consumption and the wear on the engine. Some engines are equipped with tension springs on the shifting lever to equalize the strain on the belt and avoid excessive tension.

Fuel for Motor-Car Engines

Ordinary commercial gasoline with a flash point of 50 to 60 is the most satisfactory and economical fuel for motor-car engines. Experiments have been made with cheaper grades of fuel such as kerosene and distillates but they have not proved to be practical in operation. High-test gasoline has also been used to some extent, especially for priming engines in cold weather. It is higher in cost than commercial gasoline and there is no advantage in its use, if proper methods of winter operation are followed.

The distribution of gasoline for motor cars varies with local conditions. Where supply cars or trains are operated, the gasoline is delivered direct by the stores department. In other cases it is deliverd by the oil companies in tank wagons and is sometimes shipped by freight in drums. Some roads deliver gasoline ready mixed with lubricating oil for use in two-cycle engines. This is desirable where practical as it eliminates the necessity for mixing the gasoline and oil in the field and simplifies the problem of engine lubrication.

The gasoline is usually stored at motor-car houses and gang headquarters in 50-gal. steel drums or in underground tanks equipped with gasoline pumps. The latter method of storage is preferable as the fire hazard is reduced and there is less waste and loss through evaporation. When gasoline is carried in tool houses, it should be kept in steel drums or in an approved storage tank. Pumps on underground tanks and faucets of storage tanks should be kept locked, and plugs in drums should be screwed in tightly to prevent loss from theft. Cans containing gasoline should be placarded to indicate that they contain inflammable material.

Avoid Waste of Gasoline

Gasoline is one of the principal items of expense in the operation of motor cars. Economies in its use are possible in many ways. A great deal of gasoline is wasted by careless handling, as in drawing it from a drum, transferring it from one can to another or in filling fuel tanks on motor cars. Gasoline spilled in this manner is not only wasted but creates an added fire risk as well. Gasoline is very volatile and if a drum or can is left open, the loss through evaporation is rapid. Washing the hands and pieces of machinery in gasoline is also a wasteful practice.

Perhaps the greatest waste of all in the use of gasoline is caused by the improper operation of the engine, or the adjustment of the carburetor. The speed of the engine should be controlled by the throttle and the throttle valve should not be open with the spark off. The engine will consume as much gas while coasting with the throttle open and spark off as it will under load. Retarding the spark to reduce speed consumes an abnormal amount of gasoline and tends to overheat the engine and form carbon deposits. Improper adjustment of the carburetor is also a prolific source of waste; it should be properly adjusted by the motor-car maintainer, and should not be tampered with by anyone not familiar with its operation.

Operating in Winter Months

Gasoline does not vaporize readily at low temperatures; therefore, greater care is necessary in starting a gasoline engine during the winter months, particularly as regards the condition of the engine. Slight defects in the engine, such as loss of compression, and particularly in the carburetion and ignition which would not be noticeable in warm weather, will sometimes cause trouble in starting during cold weather. Batteries which have been partially exhausted may be the source of the trouble rather than the gasoline. For example, the amperage of a dry cell battery will probably drop from 30 to 10 or 15 after several months' use, while under the influence of extremely cold weather it may drop to zero and as a result no spark will be obtained. Such a battery can be made effective temporarily by warming it.

The condition of the timer contacts is also of im-

portance. A short timer contact or a dirty timer may work satisfactorily in the summer time, but it is liable to cause trouble in starting a cold engine in the winter time. The spark coil, carburetor, spark-plug electrodes and magneto should be properly adjusted at all times, but these measures are of greater importance in cold weather; if particular attention is given to the question of ignition and carburetion during extremely cold weather, complaints in regard to the quality of the gasoline will be overcome.

A few simple rules for operating motor cars in cold weather are given, which, if followed, will eliminate much trouble and delay, particularly in starting the engine. Immediately preceding the winter season, the motor car repairman should inspect all motor cars and perform the following work:

Ignition Inspection

1. Test batteries and remove all cells registering below 10 amperes.
2. Renew any defective wiring.
3. Test spark coils for leakage, renew any defective points, and at the same time adjust the tension to equal the battery current.
4. Inspect timers, renewing any defective parts and making sure that the maximum duration of contact is secured.
5. On magneto-equipped engines, the interrupter points should be dressed or renewed, collector and ground brushes properly seated and armature bearings lubricated with an oil of the right consistency for cold weather.
6. Spark plugs should be adjusted to the proper gap and any with broken or cracked porcelains removed.

Engine Inspection

1. On four-cycle engines carefully check and adjust intake and exhaust valves.
2. Remove any foreign substances in the carburetor bowl or sediment bulbs, making sure that the screen is free from corrosion.
3. Renew any parts of the carburetor which may be worn and apply any needed gaskets.
4. Inspect carburetor and manifold connections, making sure that they are properly gasketed and do not leak.
5. On two-cycle engines, inspect the side or main bearings and renew or repack as the case may require.

In extreme cases, it may be necessary to warm the engine or intake manifold. This should never be done with an open flame, and if any heat is applied it should be done by filling the hopper or radiator with hot water, or by applying hot bricks, stones, or bags of sand to the intake manifold and carburetor. If the engine, carburetor and ignition system are kept in proper condition, it will rarely, if ever, be necessary to resort to these measures.

Direction of Operation

The question as to which end of a roadway motor car should be run forward has long been a subject of discussion among both manufacturers and operators. All cars are equipped with a tight and a loose wheel on one axle. The chief point of discussion is whether the loose wheel should be in front or behind. As the car is driven from the axle with both tight wheels, the position of the loose wheel also determines whether the car is front or rear drive. No set rule for direction of operation can be established, however, as the motor cars of different manufacturers and even different cars of the same make operate in some cases with the loose wheel forward and in others with it in the rear, while some manufacturers maintain that their cars will operate equally well in either direction. Where the bearing of the loose wheel is well fitted and there is no possibility of poor alinement or play, it is quite as safe on the front end of the car as on the rear. Whether the loose wheel is run front or rear special care should be exercised to insure that it is in correct alinement and that there is no play or lost motion.

The position of engines on motor cars determines the front end to a certain extent, as the car should be operated in the direction that will insure the greatest circulation of air about the cylinder of the engine. Where water-cooled engines are equippd with radiators or condensers the front end of the car is definitely fixed by the position of the radiator. Cars should, of course, be run in the direction specified by the manufacturer as this contemplates the most efficient operation.

A Fine Screen in Funnel Strains Out Many Fuel Troubles

Rules for Motor Car Operation

The following rules have been drafted as representing good practice in motor car operation:

(32) One man should be responsible for the operation of the car and for its condition. Divided responsibility invariably results in neglect and poor operation.

(33) Do not race the engine, particularly when cold. More engines have been ruined by racing than have been worn out in use.

(34) Stop and examine the car carefully if knocking or strange noises are heard while running. It may indicate serious trouble with the engine or car.

(35) Keep the cooling system of a water-cooled engine supplied with clean water.

(36) Drain the water from the cooling system of a water-cooled engine when it is necessary to prevent damage from freezing.

(37) Use care in starting cars with free-running engines; apply the power gradually and avoid jerky starting.

(38) Do not apply more tension to belts than is required, as excessive tension overloads the engine, creates friction and increases fuel consumption.

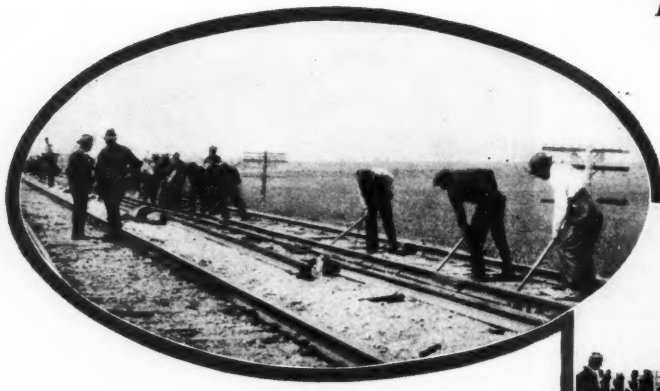
(39) Avoid waste of gasoline by using care in its handling, and in the operation of the engine and the adjustment of the carburetor.

(40) Follow special rules regarding the condition of the engine and ignition system for winter operation, and avoid trouble in starting and running the car.

(41) Do not run car backward when possible to avoid it; if necessary to back up run slowly and turn the car at first opportunity.

Putting Rail Gangs

Chicago, Milwaukee, St. Paul & Pacific develops methods to speed up work and reduce costs without lowering quality of work



Throwing Out the Old Rail

Removing the Tie Plates, Driving the Tie Plugs and Clearing Away the Ballast for the Adzing Machines

PRODUCTION is the keynote of the organization and methods for laying rail which have been developed by the Chicago, Milwaukee, St. Paul & Pacific during the past five years. At the same time every precaution is taken to insure that insistence on greater production does not result in lowering the standards of doing the work. In fact, the opposite is true, for, through the better supervision and more intensive attention to detail which the present plan makes possible, it has been demonstrated that the results in quality of work and decreased costs are greatly superior to those which were obtained under the methods in vogue before the present plan was adopted.

Under this plan, an average of more than 20,000 lin. ft. of rail, including frogs and switches, is being laid daily by a single gang and is left ready for operation at full speed after an interval of 12 hours and the passage of a few trains to settle the tie plates. Since the present system was adopted, the cost of laying rail on this road has declined progressively, until, so far this year, the cost per mile is only 50 per cent of that in 1926, the first year the plan was effective. In that year, however, a decrease of 20 per cent was effected, as compared with the cost of laying the rail under the older practice which had been followed for many years. From 500 to 600 miles of rail are laid annually by the three gangs which are organized for this work.

Briefly, the plan consists of organizing a limited number of system rail gangs, ranging in size from 150 to 175 men each, to replace the numerous division gangs used heretofore. These gangs are equipped with a full complement of power tools for every operation that can be done by machine equipment. They lay all of the rail provided for in the annual rail program for the entire system. During the time that a gang is on any division, it is placed under the jurisdiction of the division officers. As soon as it completes its work, however, it is moved to another division and continues thus throughout the season without a break in its organization. These gangs are used exclusively for laying rail and never are assigned to other work, while a skeleton organization is maintained during the winter to provide the nucleus for the next year's forces.

Heretofore, the greatest obstacle to the use of machine equipment for laying rail had been the number of gangs to be equipped. Under the former practice, each division organized its own rail-laying force, whether it had much or little rail to lay. When the rail was laid, the gang was transferred to other work or disbanded. As a result, there was little or no economy in providing power tools which would be used during only a limited period of the year; in many cases for too short a time to pay the carrying charges. The present practice permits this type of equipment to be used intensively throughout the entire working season, thus making it economical to provide the smaller number of gangs with a full complement of such machines.

Reason for Changing Practice

It is of interest, however, that, although the question of the economic benefits to be derived from equipping larger gangs with power machines was an important factor, the basic reason for changing the established practice in laying rail on this road was entirely different. The fundamental reason for this change was the difficulty experienced in getting satisfactory deliveries of the materials incidental to laying rail.

Experience had shown that under the system of division rail gangs, it was not uncommon for some of the divisions to be delayed unreasonably in their work by a shortage of certain materials, such as spikes, bolts, angle bars, tie plates or frogs and

on a Production Basis

switches, while other divisions had already distributed their quota of some of these items, but were short of other materials with which the first mentioned divisions were amply supplied. With a large number of division gangs laying or ready to lay rail at the same time, the situation frequently became intolerable, the season's program was disorganized and maintenance costs were out of proportion to the work accomplished.

Conflicting Demands for Material

The stores department, which was responsible for delivering this material, was not wholly to blame for the situation, since it was making deliveries in accordance with requisitions and endeavored to do so in the sequence in which they were received from the divisions. Manifestly, this department was not in position to discriminate between the various divisions as to the relative importance of their requirements, particularly when several of them were insisting simultaneously on immediate shipments of the same classes of material. If stocks at the storehouse became depleted, the only recourse was to delay the

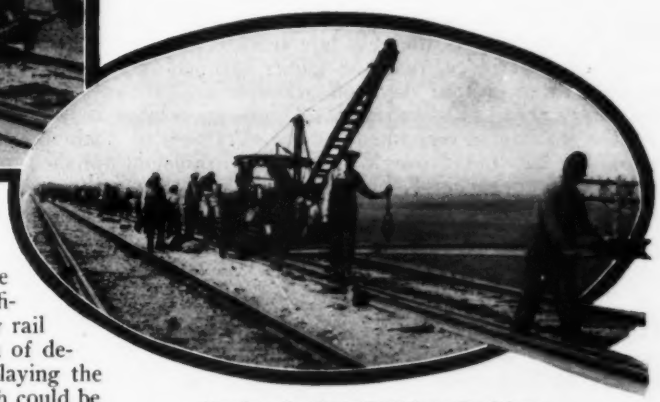
The Ties Are Adzed with a Battery of Four Nordberg Adzing Machines

work until the necessary materials could be obtained. To remove this obstacle to the efficient use of the gangs organized locally to lay rail and to provide for a more dependable system of delivering the incidental materials needed for laying the rail, as well as to create an organization which could be equipped with power machines with the assurance that these tools would be used intensively throughout the season, thus justifying their purchase, it was decided to organize a limited number of large gangs and employ them exclusively in laying rail. As the plan has been perfected, from 500 to 600 miles of rail are laid annually by three gangs, two on the lines east of Mobridge, S. D., and one on the lines west of Mobridge.

The rail program for the ensuing year is prepared and authorized for the system late in the fall or early in the winter in the usual manner. As soon as this authorization is given, the engineer maintenance of way prepares a time and place schedule for each gang for the entire year. This schedule includes all of the divisions affected by the rail program for the year. It shows for each division the territory upon which the rail is to be laid, the weight of the rail, the time of starting the work, the time the gang will be at every station, the time of completion, the size of the gang and the name of the roadmaster in charge. This information is supplied to each of the divisions, to the stores and purchasing departments, and to each of the gangs for the territory it is to cover.

A supplementary schedule is also worked out to accompany the requisitions for frogs, switches and track fastenings. This second schedule shows in detail the quantities to be shipped to every station and the latest date permissible for their arrival. This information is also given to the stores and purchasing departments, the divisions and the gangs interested.

In this way the stores department is given definite information, well in advance of the first shipment, of the quantities, the sequence, and the date and place of delivery of all of the material which will be required during the year. This department assumes the entire responsibility for having the material on hand when and where needed. The plan for scheduling the deliveries and the fact that only three gangs now require material have simplified the problem to such an extent that the stores department has not yet failed to have the shipments at the designated points in accordance with the schedule. As a result, none of the gangs has been delayed because of a shortage of material since the plan was put into effect. In addition, the supervisory forces on the divisions are relieved of this responsibility and are



Laying the New Rail into Position

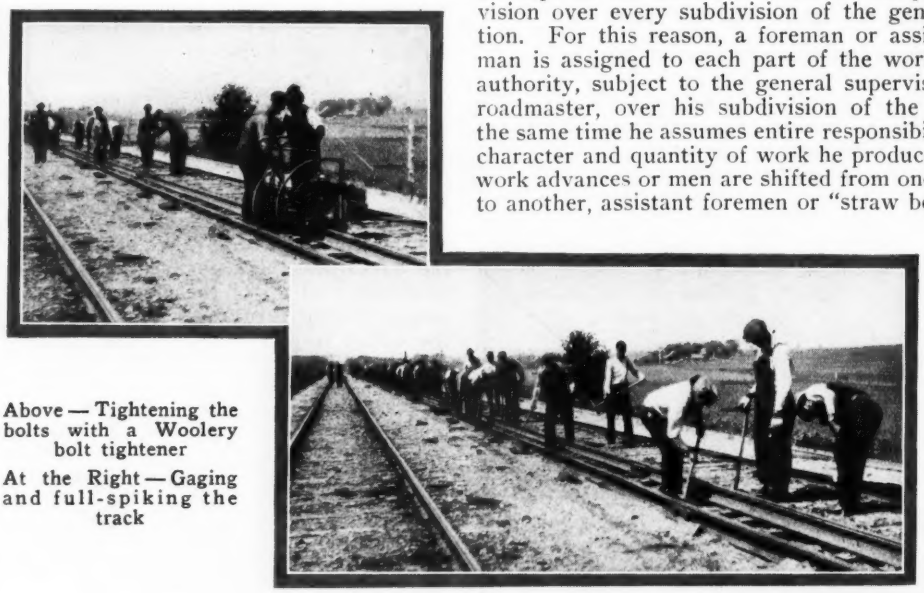
thus able to devote more time to other maintenance matters.

The rail and switch material are distributed as they are received by a gang organized for this purpose. The bolts, spikes, tie plates and other fastenings are unloaded at the stations by the division forces in order to release the cars and are distributed by the rail gang ahead of the work.

While the engineer maintenance of way retains the general direction of the several gangs and they are moved from one division to another in accordance with his instructions, the plan provides definitely that when a gang is sent to a division it is to be placed

directly under the jurisdiction of the officers of that division and they are responsible for its performance while it is there. The time of the men and foremen is carried on the division pay rolls and all questions relating to work trains, slow orders, diversion of traffic and other procedure are handled with the division officers the same as if the gang had been recruited locally. The local officers have no authority, however, to assign other work to the gang, except on the authority of the general manager or engineer maintenance of way.

Standards of work have been prepared and the division officers are held responsible for seeing that they are followed, and that the work is advanced in accordance with the schedule. It is a matter of interest, so carefully is the schedule worked out in the light of experience, that the gangs are seldom more than three or four days off schedule and are as frequently ahead of as behind it. Questions relating to the shifting of equipment or the obtaining of supplies are handled through the regular division channels with the general superintendent and engineer maintenance of way.



Above — Tightening the bolts with a Woolery bolt tightener

At the Right — Gaging and full-spiking the track

Three Gangs Lay All Rail

One gang is able to lay all of the rail required on the Western lines. On the Eastern lines, where the mileage is larger, one gang is assigned to Class A track and a second gang to Class B and C lines. The organization, equipment and method of doing the work is the same in each case, however. All of the rail that is released from Class A main track is shipped to the rail-conditioning mill at Savanna, Ill., where it is sawed, straightened and redrilled for use on Class B and C lines. Much of the rail released from the Class B lines is also suitable for use on Class C lines and on passing sidings, and this is reconditioned in the same manner. If authority has been secured for relaying passing sidings, the rail gangs relay these tracks as a part of their regular work. New angle bars and other fastenings are used on all reconditioned rail, except that second-hand tie plates and rail anchors are reused wherever they are suitable for this purpose.

Each of the gangs is placed in direct charge of a roadmaster who is without assigned territory, but moves with the gang from division to division. He has four foremen and seven assistant foremen under him. There is a definite normal assignment of the men to the various parts of the work, but the organization of the gang is so flexible that they can be shifted at once from one operation to another, as needed, to keep the work as a whole correctly balanced.

Provide Adequate Supervision

Two fundamental principles are borne in mind at all times. First, that neither the quality of the work produced, nor the amount of work accomplished can be kept at the maximum without adequate supervision over every subdivision of the general operation. For this reason, a foreman or assistant foreman is assigned to each part of the work with full authority, subject to the general supervision of the roadmaster, over his subdivision of the gang. At the same time he assumes entire responsibility for the character and quantity of work he produces. As the work advances or men are shifted from one operation to another, assistant foremen or "straw bosses" may be selected from among the laborers who have shown superior ability, and assigned temporarily or permanently to certain of the operations.

The second principle which is always kept in mind is that the full efficiency of the gang cannot be maintained, thus reducing the amount of work accomplished, unless every part of the work progresses at the same uniform rate. While adequate supervision by the foremen, of every detail to insure that there shall be no lowering of the standards of doing the work, is stressed at all times, the importance of every subdivision of the gang maintaining the same uniform rate of progress, and that this shall be kept at the maximum, is so great that it is given constant attention.

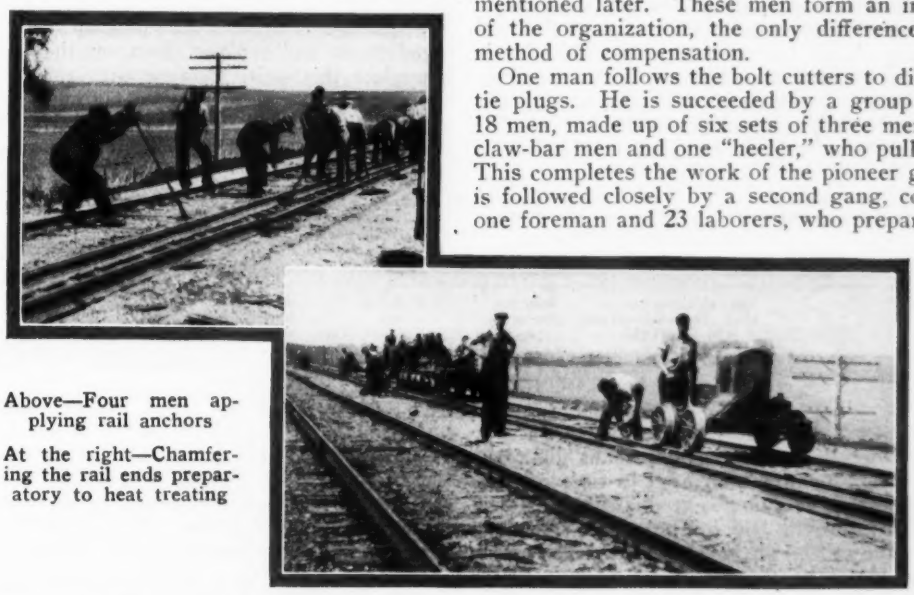
If any of the units of the gang show a tendency to advance more rapidly than the average, a sufficient number of men are shifted at once from this unit to some other part of the work. If any of the operations lag, the cause is determined and, if more laborers are needed, they are sent immediately. In fact, so well have the methods of handling the work been perfected, that these changes seem to a visitor to be made automatically. It is evident that if any unit is advancing more rapidly than it should, full efficiency cannot be obtained, because part of the time it is waiting on the unit next in advance. Likewise, it is equally obvious that when any unit lags it retards all of the force that is behind it. In addition, there is an ever widening gap between it and the unit next in advance. In either case the entire operation is

thrown out of balance, the work becomes disorganized and production is definitely reduced.

The following description of the manner in which these gangs perform the various operations is based on a rail renewal project on double track where one track is turned over to the gang during the working hours. The roadmaster in charge of the gang keeps in close touch with the division transportation officers and arranges with them for "killing" the track and diverting traffic. At night the track is returned to operation under appropriate slow orders. Compression bottom tie plates are used and this practice of restricting the speed of the first trains passing over the new rail insures that they will settle into the ties without affecting the gage. On the following morning, if the rail is laid beyond the temporary crossovers which are used in diverting the traffic, all speed restrictions are removed. As soon as the track is returned to normal operation the responsibility for its maintenance devolves upon the regular maintenance force, until the ballasting gang arrives. The latter gangs are organized in a manner somewhat similar to the rail gangs and follow up all rail laying operations. The organization and methods they employ will be described in a later issue.

Sequence of the Various Operations

It is customary on both single and double track to lay the rail on one side of the track one day and go back and lay on the other side the following day. This permits the work to be carried on throughout the day without a break and eliminates the loss of time which would ensue from shifting back and forth from one side of the track to the other. The make-up of the gang is varied from time to time as dictated by fluctuations in the number of men or by conditions that may tend to throw the progress of the different parts of the work out of balance, but the typical distribution of the labor is as shown.



Above—Four men applying rail anchors

At the right—Chamfering the rail ends preparatory to heat treating

Following the sequence of the various units and their operations, all of the work preparatory to throwing out the old rail and of preparing the new rail for laying is done by the first unit, consisting of 37 men and one foreman. Four men distribute the tie plates, two throwing the bundles into the center of the track, distributing them so that there will be the correct number to the rail length. Two men follow, cutting the wires and spreading them uniformly so that they will be within easy reach of the plate setters.

A group of four men prepare the new rail for setting into the track. The first one turns the rail up "workway" and drops one bolt at the rear end. The second oils the web, flange and fishing surfaces at both ends where they will be covered by the angle bars. The next two "hang" the angle bars on the rear end of the rail, drawing them up with one bolt in the forward hole, so that in laying they will slip easily over the adjacent rail, yet not be too loose.

Preliminary Adzing Required

Six men adze around the spikes. This has been found necessary even where tie plates are used, since many of the older ties are plate cut, particularly if they are soft wood. At the time one of these gangs was visited, many treated ties were noted which the dating nails indicated had been in service for periods up to 23 years. The tie plates had settled into these older ties so that it would have been difficult if not impossible to pull the spikes without adzing.

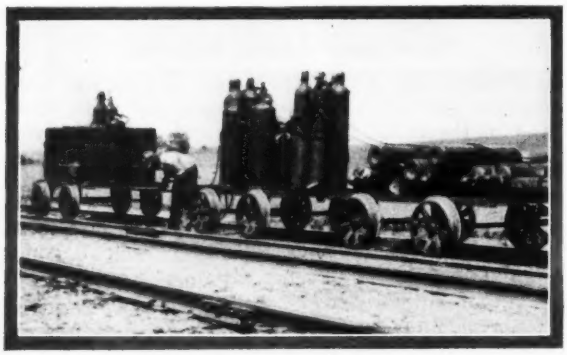
Next, four men cut the nuts from the bolts and clip the bond wires. These men were formerly on an hourly basis, but a careful record of this part of the operation indicated that the cost of uncoupling the rail was excessive. After some tests were made the work of uncoupling the rail and removing the anti-creepers was contracted on a piece-work basis at approximately half of the former cost. Six men are required to keep abreast of the normal progress, the four already mentioned and two who will be mentioned later. These men form an integral part of the organization, the only difference being the method of compensation.

One man follows the bolt cutters to distribute the tie plugs. He is succeeded by a group numbering 18 men, made up of six sets of three men each, two claw-bar men and one "heeler," who pull the spikes. This completes the work of the pioneer gang, which is followed closely by a second gang, consisting of one foreman and 23 laborers, who prepare the track for the setting in of the rail.

The first group in the second gang consists of four men who throw out the old rail, shoving it clear of all subsequent operations. One man removes the old tie plates. Next, six shovel men clean the ballast from between the ties to a level slightly below the seat of the old plates and one man sweeps the tops of the ties to remove any ballast or grit which might affect the adzing machines; one man drives down the old spike stubs; three men insert tie plugs in the spike holes; and two men drive them to place.

The ties are now ready for adzing, and this is

done by the third unit which is equipped with a battery of four Nordberg adzing machines, which require one foreman, four operators, one mechanic and one helper. Studies which were made to determine the best method of using these machines indicated that equally good results can be obtained and better time made by working progressively over every tie, as compared with the system of spreading out the machines so that each of them would complete a certain number of ties to the rail length. As they are operated, the first machine makes a preliminary



The Rail Ends Are Heat Treated to Minimize Batter

cut, followed by the second and third machines, while the fourth one does the finishing. By this method the adzing progresses about as rapidly as a man can walk slowly, and four machines will do approximately as much work as six will do by the other method. Every tie is given the same attention, no discrimination being made between good ties and those that are slated for renewal. No difficulty is experienced in keeping ahead of the rail-laying machine or in keeping pace with the progress of the other sections of the preparatory work.

The final unit in the second gang, consisting of five men, follows the adzing machines to place the tie plates. Four men set intermediate tie plates on all ties, since there is no means at this time of determining the location of the joints. The fifth man accompanies the rail-laying machine and replaces the intermediate plates at the joints with joint plates as the rail is laid.

The rail is laid with either a K. & W. or Burro rail-laying machine, requiring the services of one foreman, one operator and three men. One man handles the rail tongs, two guide the rail into position; the rear man, or "heeler," places the expansion shim and tightens the single bolt in the joint.

Mention has already been made of the fact that the angle bars are applied or "hung" on the rear end of the rail by one of the preparatory units. Experience has shown that when this is done, the rail can be set in place with so much greater facility than when they are hung on the forward end, that there is a saving of approximately 30 to 35 min. to the mile. With an operation as extensive as this, carried out with the speed that is maintained by these gangs, attention to this seemingly unimportant detail permits the laying of about one mile additional during a nine-hour day.

The rail crane has sufficient reserve power to haul several trailers without interfering with its main function of laying the rail. This made it possible to arrange an effective and economical method of distributing the spikes, bolts, spring washers and anti-creepers. Two trailers are attached to the rail crane, the first of which carries a water tank and a reserve supply of small tools. The second or rear one is used for material distribution. Two men pick up the kegs, boxes and sacks in which the spikes, bolts, spring washers and anti-creepers have been distributed previously along the track, and place them on the car. Two men on the trailer open the packages and distribute the fastenings in accordance with the requirements for each rail length.

Immediately following the distribution of these materials, the fifth unit, which also includes the four men making the distribution, applies the track bolts and does the gage spiking. The bolts are inserted by four men who are equipped with short wrenches to start the nuts. They are followed by two men who operate a Woolery power bolt tightener. This machine is so designed that when the desired tension in the bolts has been obtained it trips automatically and is ready to be applied to the next bolt. One machine is able without difficulty to keep up with the regular progress of the work. Four sets of gage spikers follow the bolt tightener, each set including one man to handle the gage and two to do the spiking. Two men who pick up scattered or damaged tools and replace them on the supply trailer complete this unit.

The sixth unit of 27 men completes the spiking and applies the rail anchors, four men being assigned to the latter task. One man removes the expansion shims and carries them forward to the rail-laying crane. Working alongside this unit, but not a part of it, the two men mentioned previously in connection with uncoupling the rail remove the bolts, angle bars and rail anchors from the old rail.

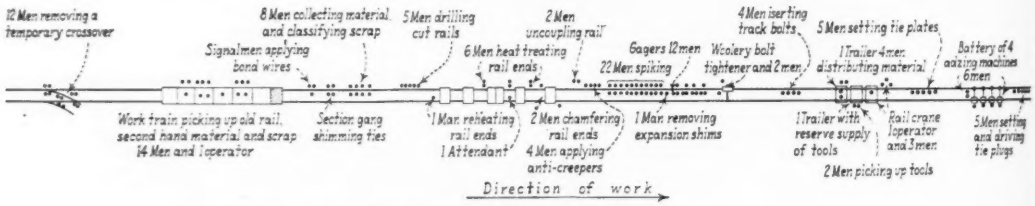


Diagram of the Rail Laying Organization

Heat Treating the Rail Ends

The work of the next unit is an interesting innovation in rail renewal as well as in ordinary track maintenance, which is being tried out in a systematic way this year for the first time. As a result of experiments which have been carried out in a limited way for a year or two, it was decided to chamfer and heat treat the ends of all new rail laid this year, with a view to reducing the amount of batter and chipping, with which the Milwaukee, in common with all other roads, has had to contend. Conclusive statements of the results may not be possible for two or three years, but the preliminary investigation

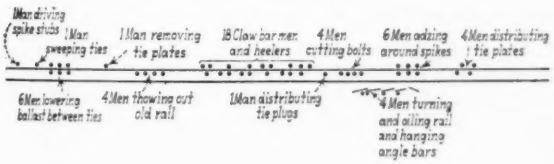
indicated that the benefits to be derived from this action may be entirely out of proportion to its cost. In any event, the trial is being made on a large scale, involving approximately 218 miles of new rail, and should, therefore, indicate in a definite way whether the results will justify the cost.

Experiments indicated that, while the flow of the metal under the rolling wheels cannot be prevented entirely, this action can be reduced to a marked degree by heat treating the contact surface of the rail head to provide a film of case-hardened metal to resist the action of the wheels. It was found, however, that the only method of heating and quenching which was practicable with rails applied in the track, resulted in making this case hardened area quite brittle. To overcome this condition, the treated area is reheated to a lower, but well-defined, temperature and allowed to cool naturally. This reduces the hardness only slightly but eliminates the brittleness and results in a remarkably tough condition of the metal.

One foreman and ten men comprise the heat treating unit. The cross-beveling or chamfering of the rail ends is accomplished by means of an electric-driven hand grinding machine which receives its power from a Syntron generating unit. Two men are required in this operation, one man to do the grinding and the other man to attend to the generator and push it along the track. The heat treating requires three men to operate the oxy-acetylene torches, three men to do the quenching, one attendant to look after the hose and connections and one man reheating the rail.

Scrap Classified Before Shipment

A small gang, one foreman and five men, follows at varying distances to drill and insert the bolts in the joints of cut rails at road crossings, insulated joints and switches. Back of this gang is the ninth unit, consisting of one foreman, one assistant foreman and eight men, which collects and sorts the old material, separating that which is usable from the scrap, and piling both in neat piles for loading in the material and scrap cars on the work train. The discarded spike and bolt kegs are used for collecting the usable material to facilitate loading. This gang classifies the scrap in accordance with the requirements of the stores department, the several classifications being loaded into separate cars, so that when a load is completed it ready for sale without further handling. These cars are billed direct from the point of origin to the consignee designated by the purchasing department. Any new material which has been left inadvertently is segregated and returned to the gang.



All material, including the released rail, is loaded currently and this work follows closely behind the laying of the new rail. The average location of the work train used for this purpose is about one mile to the rear of the heat-treating unit. By following this system, the work train is able to load without interruption by traffic and does not interfere with the movement of trains. Furthermore, when the laying of the rail is completed, the work can be closed up in two or three hours and the gang moved to another division without leaving any part of the work unfinished.

A work train equipped with a locomotive crane or an air-hoist rail loader which takes its air from the train line is assigned permanently to each gang to distribute the new track material and pick up the released rail, fittings and scrap. The work train gang, the tenth unit in the operation, consists of one foreman, one material clerk, one crane or hoist operator and 14 laborers. As soon as it is loaded, the released rail is shipped to the company's rail reclamation plant at Savanna, Ill., where it is classified for relayer use and sawed, drilled and otherwise reconditioned as may be necessary. No attempt is made to classify the rail in the field.

Turnouts Renewed in Advance

One of the important units of the operation has not yet been mentioned since, in general, it works independently of the main operation. This unit of 12 men, under a foreman of long experience, is the eleventh and final one in the gang. It works from station to station in advance of the remainder of the gang to install the temporary crossovers which are necessary for the diversion of traffic, and later removes them when they have served their purpose.

A specific requirement of the general plan for laying rail is that no part of the work shall be passed over to be done at a more convenient time. It must be completed as it progresses. For this reason all turnouts are renewed before the laying of the rail is allowed to progress beyond them.

To minimize the delay incident to relaying the turnouts, as well as to facilitate the replacement of broken or damaged parts by the maintenance forces, the Milwaukee has adopted standard plans which require the use of stock rails of uniform length and rails of specified length through the turnout for each turnout angle. This plan also requires that the stock rail and opposite running rail shall have even joints 12 ft. ahead of the points in No. 11 turnouts and 12 ft. 2 in. ahead of the points in No. 16 turnouts.

To facilitate the work of relaying the switches, the stock rails and all short rails required in the assembly are shipped with the frogs and switches. The guard rails are bolted to the proper running and turnout rails when received. The unit which installs the temporary switches assembles the points, stock rail, the remaining rails, the slide plates, the rail braces, etc., setting the switch up alongside the track in advance of the arrival of the gang, so that only a small amount of time is consumed in relaying the switch more than would be required to lay the rail.

Two units which are not included in the gang, being part of the local division forces, but which perform necessary duties in connection with the laying of the rail, accompany the gang at all times. The first of these is the section gang on whose section the rail is being laid. The other is a signal unit consisting of three or more men who install the bond wires and supervise the application of insulated joints. The section gang follows between the heat-treating unit and the drilling gang to shim any ties that may be low, a condition that occurs particularly where part of the ties were not plated previously and where an occasional tie must be adzed below the old seat. It is a cardinal principle in laying the rail

that the ties shall not be disturbed on their beds.

In addition to the men assigned to the several units, those whose duties are general include one timekeeper, one tool grinder, one tool repairman, who is also custodian of the reserve supply of tools which is kept at the camp, three water boys and two flagmen when working on single track. The tool grinder accompanies the gang and does such sharpening and light repairing as can be done readily in the field, a grinder being affixed to one of the trailers for his use. The repairman remains at camp and does the heavier repair work such as grinding chisels, facing spike mauls, renewing broken handles, etc., for which a power driven grinder and other similar equipment is provided.

Plan to Use More Power Tools

At the beginning it was stated that power tools are used for every operation that can be performed by such equipment. In describing the details of the work, however, it was shown that the spikes are being pulled and driven by hand, an apparent inconsistency since power tools for these purposes are

Gang No. 1 Roadmaster W. A. Moberly Location Green Island, Sabula Date 4/1 to 4/7, 1930.

Total Miles Rail Laid to Date - 43.04 Total Miles Rail Laid on Iowa Division to Date 15.94

Date	No. of Laborers	Total Hours Worked by Laborers	Waterboy	Toolman	Distributing Rail & Fastenings	Pulling Spikes	Throwing Out Old Rail	Adzing Ties	Driving Plugs	Laying Rail	Lineal Feet Rail Laid	Spiking	Bolting	Applying Tie Plates	No. Tie Plates Applied	Applying Rail Anchors	No. Rail Anchors Applied	Remove Shims	Loading Rail (old)	Oiling Rail	Hanging Angle Bars	Drilling Holes	Cleaning Track	Picking Up Scrap	Repair Machines	Move Camp	No. General Foremen	No. Foremen	No. Asst. Foremen	No. Timekeepers	No. K. & W. Operators
April 1	166	1439	27	27	60	275	36	85	36	27	19500	290	90	55	12000	45	4000	9	81	9	27	55	40	147	18		1	3	6	1	2
2	167	1445	27	27	60	255	36	90	36	27	20475	310	90	58	12800	48	4200	9	81	9	27	50	45	104	16	50	1	3	6	1	2
3	179	1415	27	27	60	255	36	90	36	27	20007	318	90	58	12312	48	4104	9	81	9	27	45	45	119	18		1	3	6	1	2
4	176	1545	27	27	64	250	36	90	36	27	20046	320	90	60	12336	48	4112	9	81	9	27	40	45	144	15	110	1	3	6	1	2
5	173	1521	27	27	60	255	45	95	45	27	23478	345	90	65	13248	50	4816	9	81	9	27	45	45	158	16		1	3	6	1	2
6	1	9		9							Sunday																1	1	1	1	2
7	159	1366	27	27	40	240	40	85	40	27	21394	325	80	60	13104	45	4368	9	81	9	27	37	40	125	12		1	3	6	1	2
Total	1022	8740	162	171	314	1530	229	535	289	162	124800	1908	530	356	75600	284	25600	54	486	54	162	282	260	797	95	160	7	19	37	7	14
Average Per Day	170	1455	27	27	52	255	38	89	48	27	20800	318	88	59	12600	47	4267	9	81	9	27	44	43	133	16	27	1	3	6	1	2

A Weekly Performance Sheet of One of the Rail Gangs

readily available. It was found, however, that, while these tools were very efficient in both time and economy, in an operation which moves forward as rapidly as the laying of the rail does, the time consumed in handling the power plants, particularly on single track, where they must be set off the track to clear trains, retarded the progress of the work. Efforts are being made to develop lighter equipment for these purposes and it is hoped that by next year this will be perfected so that the entire operation will be on a mechanical basis.

Daily reports are mailed to the engineer maintenance of way showing the number of laborers, foremen and assistant foremen employed, the total hours worked, the labor distribution to the various parts of the work, the lineal feet of rail laid and the amount of material applied. This information is tabulated in the form of a weekly report, showing on a single sheet these details for each of the gangs, thus affording an easy comparison of the results obtained by the several gangs.

Results Obtained

Large floating gangs were first used in 1926 and, although the practices have been prefected in the light of experience, no change has been necessary in the fundamental ideas underlying the policy then inaugurated. At that time four gangs of 100 to 125 men each were organized, one for each general superintendent's district, and each one laid approximately 100 miles of rail during the season. Since then the number of gangs has been reduced to three and the number of men to the gang has been increased to about 150 to 175. In 1926 the only power equipment furnished was the rail-laying cranes and air-hoist rail loaders, all other operations being done by hand.

In the face of the difficulties always encountered in making a radical change in practices and despite the fact that practically all of the work was still done by hand, the reduced cost of the work for that year showed that the change was amply justified. As the organization has been perfected and power tools have been added to the equipment of the gangs, costs have declined steadily until today they are extremely low. In 1926 there was a saving of 20 per cent in the cost per mile, as compared with that in previous years. Comparing the cost in subsequent years with the cost in 1926, there was a decrease of 8 per cent in 1927; of 26 per cent in 1928; of 36 per cent in 1929; and of 50 per cent so far in 1930. In other words, the cost for the present year is only 40 per cent of that under the system of division rail gangs which was in vogue prior to 1926.

Aside from the direct results there are other advantages of the plan which, while more or less intangible, are of great value. The better supervision which is made possible results in a closer adherence to standards; a new spirit of co-operation between departments has been engendered, particularly with the transportation and stores departments; the size of the gangs keeps prominently before every officer and department interested the importance of expediting their progress; there is less interference with traffic than there was with the larger number of gangs; in general, the ballasting and surfacing of the track follows more closely after the rail is laid; the limited number of gangs working on a definite schedule facilitates the delivery of material and reduces the labor of accounting; and the division maintenance forces, being relieved of the responsibility and labor connected with the laying of the rail, are able to apply their efforts to other features of maintenance.

The present system of laying rail was developed and has been perfected by W. H. Penfield, engineer maintenance of way, and William Shea, assistant engineer maintenance of way. The yearly rail programs are also prepared by them and carried out under their supervision.

This Roadmaster

Talks Safety

*Direct to the Man**

Proper organization and supervision are basic requirements of 100-per cent safety records

By C. E. SOUSER
Roadmaster, Union Pacific, Gering, Neb.

SOME TIME ago I told you men that I was going over the safety-first movement in detail out here with all of you right on the track. Previous to this time I have talked mainly to the foremen, but from now on I shall talk to each one of you. I intend to go over all of the rules and regulations with the end in view that we have less personal injuries charged to us at the end of 1930 than we had at the end of 1929. Our safety performance on the majority of the sections on this district is always 100 per cent, although it will interest you to know that eight of the ten personal injuries which occurred on the..... branch during the past eight years occurred on the same three sections.

Year after year there is a personal injury on one of these three sections in spite of the working and other conditions being equal, and there is a reason. I once listened to a conversation which answers the question. A foreman said to the general superintendent, "That foreman is certainly lucky, he has gone a whole year without a personal injury to any of his men." The general superintendent replied, "Luck, Hell! there is no such thing as luck, that was a matter of supervision!"

Mr. Brady, our safety agent, tells us that 87 per cent of the personal injuries which occurred during 1929 were due to rule violations and unsafe practices. I know that the nine foremen on this district who went through the year with a clear record will not say that this was the result of luck. They will tell you that they put forth lots of forceful supervision.

Eliminate Unsafe Men—Train Others Early

The big thing that will prevent personal injuries is the foreman's ability to pick and organize his men. He must catch the unsafe man before he injures himself, because a man who will not be careful after being instructed must not be left in the service. The foreman who hires a man and later sees that he has made a mistake must remove him from the service and any foreman who does not do this has no place in our organization. Get the man off your section at once, and tell him why you are removing him in front of the men on the gang in order that they know just what is expected of them and that they may know that we are working for their own safety.

When a man is put on, make it your first order of business to work with him and if he has not had any experience in track work take pains to point out to him any mistakes he makes. Show him the safe way of doing the work and impress upon him the necessity for his own safety and that of the other men. If you find that after a fair trial a new man does not want to work safely, report the matter to your foreman. The foreman cannot afford to take the chance of being a good fellow. I have seen a serious collision which was the result of an unsafe man at work who should not have been allowed on the railroad. You boys know what I mean, a man you could not handle a dozen ties with without his pinching you or dropping one end of a tie on your foot. No foreman who has one or two men of this kind in his gang has an organization, because luck will not carry him through and it is only a matter of time until a personal injury is received.

Defective Tools and Improper Use Dangerous

It often develops that a tool will become defective while in use only a short time after being inspected. If a tool handle becomes loose, the tool battered, etc., report it to your foreman because he has absolute instructions against the use of defective tools.

A number of personal injuries occurred during 1929 because of the use of tools on work for which they were never made. Take the personal injury on Section No. — as an example. The injured party was driving a track chisel under a switch stand to raise the spikes and the usual thing occurred—a glancing blow was struck and a piece of steel flew from the chisel into the man's leg, resulting in the man being off work for three months.

Another case of the seriousness of using the wrong tool was demonstrated at ..... An extra gang laborer was using a track chisel to drive off a rail joint and after a few blows a piece of steel chipped from the chisel and went into one of the man's eyes, resulting in the total loss of the eye. Your foreman has positive instructions against the use of the track chisel for this sort of work and he also has instructions to use safety goggles when cutting steel, grinding tools, etc. The man wearing goggles is protected and it is for this reason that we furnish them and demand their use.

Whenever grinding tools, the man grinding and the man turning the grinder must have goggles on and when doing other dangerous work the man striking and the man holding the tool must have them on. Should your foreman ask you to do dangerous work without goggles, call his attention to the necessity for them and do not depend upon luck to save your eyes. If this man at ..... had worn his goggles, he would have received only a flesh wound on

*This is an abstract of a paper which Mr. Souser presented before each section gang on his district last February.

his face and would still have the use of his lost eye. A track chisel was never made to remove rail joints, angle bars, etc., and I have often made it plain to you how this work can be done safely. The use of the right tool is the result of supervision, and advance supervision prevents such injuries as this. In this respect I am going to make it plain to you that if you are caught by any officer violating the instructions I have just reviewed, you will be discharged.

I want to call your attention to the fact that a check of track chisels and punches found on some sections on the ..... branch developed that some foremen do not have men who are striking the chisel a square blow. Tools show that they have been struck many times one inch from the center and in many cases only ¼ in. from the edge. There is no tool made that will not chip when struck in this manner. They are made to be struck with a square blow and will stand up well if so handled. You have instructions to use the sledge for heavy work and I want to see this done. The spike maul was made to drive spikes and for light work, not for sledging. I am going to depend upon you men to use the right tools.

Work Trains and Bulletins

You men can help your foreman around work trains by watching each other to see that all are in the clear and by giving new men special instructions. You are not allowed to ride between cars of any kind, or stand up and ride on a flat car, or hang on the side of a car. I will repeat that neither the foreman nor the men in the gang are to give signals to enginemen. A foreman has plenty to do when looking after the work, watching his men and seeing that they are properly placed before giving word to the trainmen that all is ready for movement. I have noticed that some trainmen get nervous and nag the men to hurry the work when their time is nearly up or if they are in a hurry to get a car released. Pay no attention to them whatsoever. The foreman will handle the situation well without any advice from trainmen. If they do not want to wait until a car is unloaded, they can set it out. You can not have men excited when unloading ties or rail. Do not overlook the fact that tools must not be thrown from the cars as they may hit someone on the ground. There is no luck around a work train, it is supervision and organization. On my last safety tour over this district I called your attention to the hazards of getting your feet injured. The trump card in safety-first work is "watch your step."

When a personal injury occurs, there is usually a bulletin sent out that explains how the injury could have been avoided. Your foreman has been furnished with a bulletin board and has orders to hang these bulletins on that board for you to read. Read the bulletins and profit by the other fellow's mistake. If your foreman does not post these bulletins he is not interested in safety first.

The safety movement was started back around 1912 and the railroads of this country have spent thousands of dollars to make the railroads a safer place to work. They have corrected nearly everything that employees thought was not safe. Now if 87 per cent of the injuries received were the result of unsafe practices and rule violations, it is plain that our tools, equipment, etc., are about as safe as can be had and the injuries result back to lack of organization and supervision. We have seen that luck has nothing to do with your performance and your organization is going to have to be so strong that if your track walker should injure himself out on the track away from the gang, you are going to be held responsible. You have had repeated orders not to keep men who can not be trusted to avoid injury while alone.

Personal injuries continue to occur to such an extent that we are forced to remove from the service any foreman who has an injury on his section. It, therefore, behooves you to supervise and organize and remove the unsafe man before he gets all of you into trouble. Organization is nothing more than planning your work in advance, placing the right man in the right place and following the rules and special instructions religiously.

I have made it plain to you that there is no such thing as luck. Get organized, supervise properly, make up your mind that you are going to follow the rules. Carry this spirit at all times and I assure you that at the end of 1930 we shall have less personal injuries than we had at the end of 1929.

A Record Year in Wood Preservation

DURING 1929, 362,009,047 cu. ft. of timber was subjected to preservative treatment. This not only represents an increase of 26,088,668 cu. ft., or 8 per cent, over the volume treated in 1928, but comprises an increase of 16,323,243 cu. ft. over the volume treated in 1927, namely, 345,685,804 cu. ft., the previous high record. Railroad crossties still comprise the great bulk of wood subjected to treatment and the total in 1929, 213,069,309 cu. ft., represents an increase of 2,726,094 cu. ft. as compared with 1928. However, it represents a decrease of 9,626,211 cu. ft. as compared with the record of 1927. The cubic feet of switch ties treated, 14,425,642 cu. ft., is slightly smaller than the total for 1928, but in all the other classes of material treated the volume in 1929 exceeded that for the previous year and in the case of piles, 17,126,794 cu. ft., poles, 77,154,317 cu. ft., and miscellaneous material, 11,219,613 cu. ft., the volume treated in 1929 exceeded that of any previous year.

Wood Preservation, 1909-1929
Together with consumption of creosote and zinc chloride

Year	Total Material Treated, Cu. Ft.	Number of Crossties Treated	Creosote Used, Gal.	Zinc Chloride Used, Lb.
1909	75,946,419	20,693,012	51,426,212	16,215,107
1910	100,074,144	26,155,677	63,266,271	16,802,532
1911	111,524,563	28,394,140	73,027,335	16,359,797
1912	125,931,056	32,394,336	83,666,490	20,751,711
1913	153,613,888	40,260,416	108,378,359	26,466,803
1914	159,582,639	43,846,987	79,334,606	27,212,259
1915	140,858,963	37,085,585	80,859,442	33,269,604
1916	150,522,982	37,469,368	90,404,749	26,746,577
1917	137,338,586	33,459,470	75,541,737	26,444,689
1918	122,612,890	30,609,209	52,776,386	31,101,111
1919	146,060,994	37,567,247	65,556,247	43,483,134
1920	173,309,505	44,987,532	68,757,508	49,717,929
1921	201,643,228	55,383,515	76,513,279	51,375,360
1922	166,620,347	41,316,474	86,321,389	29,868,639
1923	224,375,468	53,610,175	127,417,305	28,830,817
1924	268,583,235	62,632,710	157,305,358	33,208,675
1925	274,474,538	62,563,911	167,642,790	26,378,658
1926	289,322,079	62,654,538	185,733,180	24,777,020
1927	345,685,804	74,231,840	219,778,430	22,162,718
1928	335,920,379	70,114,405	220,478,409	23,524,340
1929	362,009,047	71,023,103	226,374,227	19,848,813

These are the outstanding facts presented in the statistics of wood preservation in the United States for 1929 prepared by R. K. Helphenstine, Jr., for the Forest Service, United States Department of Agriculture, in co-operation with the American Wood-

Preservers' Association and issued annually since 1909.

In 1929, the number of plants that were in active operation was 203, or 10 more than in 1928. During that year seven new plants were constructed, or three less than were built in 1928. Of the 203 plants, 131 were of the pressure-cylinder type, 56 were non-pressure (open-tank) plants and 16 were equipped for both pressure and non-pressure treatment.

The consumption of creosote in 1929 by the wood-preserving industry of this country amounted to 226,374,227 gal., or 5,895,818 gal. more than in 1928. Of this total, 134,063,664 gal. was of domestic production and 92,310,563 gal. was imported. This represents a slight increase in the amount of creosote imported and a small decrease in the use of domestic creosote. During 1929, also, there was a further increase in the use of petroleum, the total being 29,656,181 gal. as compared with 25,075,903 gal. in 1928, indicating an appreciable increase in the use of mixture treatment. The consumption of zinc chloride, 19,848,813 lb., as compared with 23,524,340 lb. in 1928, indicates a further decline in the use of zinc chloride for preservative purposes. The consumption in 1929 is the smallest in any year since 1911 and is less than half the consumption in 1920. In so far as it concerns the use of miscellaneous preservatives, there was a pronounced increase in the use of salts, 1,188,148 lb. in 1929 as compared with 443,308 lb. in 1928. The use of miscellaneous preservatives in liquid form, on the other hand, in 1929 was only 38,410 gal., or less than 10 per cent of the 417,953 gal. consumed in 1928.

During 1929 a total of 71,023,103 crossties were treated in the United States, an increase of 908,698 over the quantity reported for 1928. Of this total, 39,538,193 were hewed ties and 31,484,910 were sawed. From the standpoint of the quantity treated, oak ties again occupied first place with a total of 23,927,593, while southern pine with 17,570,311 and Douglas fir with 7,701,137 ranked second and third respectively. These three species constituted nearly 70 per cent of all crossties treated in 1929. Fourth place was occupied by gum ties, of which 5,204,018 were treated. Next in order of number treated were beech, birch, maple and western yellow pine with quantities ranging from 2,788,687 for beech to 2,036,841 for western yellow pine.

In 1929, a total of 42,186,448 crossties or 59.4 per cent were treated with creosote; 18,515,738 ties were treated with creosote-petroleum mixture, and 8,162,276 crossties were treated with zinc chloride, a decrease of 1,879,560 from the number reported in 1928. In addition to the above, 1,628,297 crossties were treated in 1929 with creosote in mixture with zinc chloride and 80,344 with miscellaneous preservatives. Of all ties treated, 69,929,128 were for use by steam railroads and 1,093,975 ties for electric railroad use.

The table of selected items taken from the tabulation of miscellaneous materials shows increases in all items except crossing planks.

Crossties Treated—By Kinds of Wood and Kinds of Preservatives—1929

Kind of wood	Treated with creosote[1] Number	Treated with creosote-petroleum[2] Number	Treated with zinc creosote[3] Number	Treated with zinc chloride Number	Treated with miscellaneous preservatives Number	Total Number	Per cent of total
Oak	19,891,158	2,082,100	421,425	1,507,810	25,100	23,927,593	33.7
Southern pine	12,936,812	4,073,190	262,306	297,251	752	17,570,311	24.8
Douglas fir	49,657	6,615,683	.....	993,217	42,580	7,701,137	10.8
Gum	3,657,020	1,057,549	180,179	309,270	.....	5,204,018	7.3
Beech	1,197,854	450,561	182,879	954,393	3,000	2,788,687	3.9
Birch	1,092,764	910,090	66,059	689,265	3,000	2,761,178	3.9
Maple	1,018,521	552,791	66,559	1,035,604	4,912	2,678,387	3.8
Western yellow pine	1,150,959	275,181	270,102	340,599	.....	2,036,841	2.9
Tamarack	132,129	637,394	7,399	516,120	.....	1,293,042	1.8
Lodgepole pine	.....	1,198,576	47,664	753,025	.....	1,999,265	2.8
Hemlock	81,681	360,367	7,399	887,543	.....	1,336,990	1.9
Elm	34,755	86,651	50,761	59,340	.....	231,507	.3
Miscellaneous	943,138	215,605	65,565	268,839	1,000	1,494,147	2.1
Total	42,186,448[4]	18,515,738	1,628,297	8,612,276	80,344	71,023,103	
Per cent of total	59.4	26.1	2.3	12.1	0.1		100.0

[1] Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution.
[2] Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar in solution in mixture with petroleum.
[3] Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution in mixture with zinc chloride.
[4] Includes a small number of ties treated with creosote in mixture with zinc-meta-arsenite.

Statement of Material Treated by Classes (Cu. Ft.)

	1929	1928	Increase
Crossties	213,069,309	210,343,215	2,726,094
Switch ties	14,425,642	14,533,450	107,808*
Piles	17,126,794	13,665,394	3,461,400
Poles	77,154,317	64,325,976	12,828,341
Wood blocks	6,852,130	3,676,312	3,175,818
Crossarms	1,957,431	1,207,512	749,919
Construction timbers	20,203,811	20,157,747	46,064
Miscellaneous materials	11,219,613	8,010,773	3,208,840
Total	362,009,047	335,920,379	26,088,668

*Decrease.

Treatment of Miscellaneous Materials Ft. B. M.

	1929	1928	1927
Lumber	87,972,030	64,426,979	53,567,458
Fence posts	10,904,180	7,272,422	23,439,193
Tie plugs	2,018,147	1,747,026	2,045,765
Car material	942,243	542,024	1,778,928
Crossing plank	273,588	1,460,463	419,541

The Railway Industry at a Glance

Operating revenues and expenses of the Class I steam railways in the United States, from data compiled by the Bureau of Statistics, Interstate Commerce Commission

	Month of June		Decrease 1930 under 1929 per cent	Six Months Ending with June		Decrease 1930 under 1929 per cent
	1930	1929		1930	1929	
Total operating revenues	$444,848,487	$532,621,028	16.0	$2,691,464,898	$3,067,818,671	12.1
Expenditures for maintenance of way and structures	**66,807,313**	**79,708,189**	**16.1**	**375,575,075**	**414,311,013**	**9.4**
Total operating expenses	334,637,932	382,354,669	12.5	2,073,253,470	2,249,486,144	7.8
Net railway operating income	68,883,475	105,817,808	35.2	376,428,839	562,729,734	33.0

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer?

Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE NOVEMBER ISSUE

1. *By whom should the inspection of switches be made and how often? What details should be given attention in making the inspection?*

2. *What precautions, if any, should be observed in the operation of valves in water lines to prevent injury to them?*

3. *Should rails be precurved? If so, what is the minimum curvature for various weights of rail for which this should be required?*

4. *Can heavy cast iron pipe be jacked through embankments? If so, how? Which type of jack, screw or hydraulic, is best suited for this purpose?*

5. *What practical method, if any, can be employed to determine the amount of wear on track motor car tires?*

6. *What are the relative merits of cement grout and an asphalt filler for wood block and brick floors?*

7. *How long a period should be allowed for smoothing the track after the tie renewals for the year have been completed? What details of track maintenance should be given particular attention at this time?*

8. *How often should a turntable be inspected? What details should be given attention?*

Excess Heavy Relayer Rail

Where an excess stock of heavy relayer rail accumulates in the course of main-line renewal operations, what disposition should be made of it? To what extent is a road warranted in laying it on branch lines having traffic too light to furnish, in itself, economic justification for rail of this weight?

This Condition Has Not Been Reached

By M. C. Blanchard
Chief Engineer, Atchison, Topeka & Santa Fe, Los Angeles, Cal.

So far as I know the Santa Fe has never had the experience of having accumulated an excess stock of heavy relayer rail. Ordinarily the demand is greater than the supply. However, when this does happen, the question as to whether it should be used on branch lines having traffic too light to furnish, in itself, economic justification for the use of rail of this weight is a matter that apparently should be determined by the cost per mile of new rail of the proper weight to serve this traffic, taking into consideration the cost of the fastenings, as compared with the money that might be obtained through the sale of the heavier relayer rail and its fastenings.

There Are Many Outlets for Heavy Relayer Rail

By R. H. Gilkey
Division Engineer, Central of Georgia, Savannah, Ga.

The heavy relayer rail which accumulates when making main-line renewals should be assigned first to the improvement of passing sidings, intensively used house and yard tracks, enginehouse leads and other tracks where road engines are required to operate, and frequently used switching tracks. If, as is likely, the branch lines under consideration are laid with 60-lb. or lighter sections of rail, it is economical to relay them with the heavier rail and sell the lighter rail for use on logging or tram roads, or for scrap. The question that has been raised is going to become of greater importance in the future and will become more difficult to answer as greater amounts of heavy-section rail are released. Small roads and logging roads will be unwilling to pay the necessary price for rail sections heavier than their requirements demand, and main-line rail has a much shorter life than that on spur tracks, passing sidings or yard tracks. We find a minor outlet for such rail in reinforcing rail for rail-girder bridges, for posts for right of way signs, in rail crossings and right of way monuments.

There May Be Cases Where It Would Be Advantageous

By Bernard Blum
Chief Engineer, Northern Pacific, St. Paul, Minn.

The question as propounded settles quite definitely the matter as to whether the traffic on the branch line will justify the use of heavier rail from the standpoint of economics alone. We must assume that safety is not involved, since it is an important element to be considered in a study of economics. Accordingly, it would appear that the accumulation of heavy relayer rail would have no direct bearing on the question of relaying the branch line. Added to the cost of the rail itself, the cost of the labor and incidental material in relaying such a line involves a fairly heavy out-of-pocket expen-

diture. For this reason, the method proposed for disposing of the surplus rail appears to be a rather expensive way of solving the problem. The correct answer seems to be to dispose of the relayer rail to the best advantage, either through a second-hand dealer, or, as a last resort, as scrap.

In some cases there is a good demand for light rail for logging roads, tram lines and mine use, and no demand for the heavy sections. If it is found that the price which can be obtained for the light rail equals or exceeds the out-of-pocket cost of relaying with the heavy section, including the cost of new fastenings, then there would be an advantage in relaying the branch line, since considerable benefit would be derived in reduced maintenance expense because of the heavy rail.

There May Be Economic Justification

By Chief Engineer

Only a few roads have reached the stage where the supply of heavy relayer rail exceeds the demand, but those that have are confronted with a real problem. If the solution is to be made on a purely economic basis, it is often difficult to find justification for laying the rail on lines of light traffic. On the other hand, while there is usually a brisk demand for light relayer rail, the outside demand for the heavier sections may be so limited as to create almost a closed market.

In the first place, in considering the relative advantages and disadvantages of retaining and making use of the heavier rail, it must be borne in mind that, while there may be ample economic justification for the use of these sections on some or all of the branch lines that are mentioned, the various items that combine to produce this justification are difficult to trace and, even if this is done, some of them are of such a character that they cannot readily be given a money value.

Branch lines of the character suggested in the question are usually laid with light rail and most of them are not equipped with tie plates to distribute the loads on the ties, with the result that the service life of the ties is reduced by rail cutting. While there are often restrictions on the size of locomotives which may be operated over these lines, there are no such limitations on the size and lading of the cars. Many modern freight cars, when loaded to capacity, create as high stresses in the track as are caused by heavy locomotives moving at moderate speeds. On this basis, it seems to me that, while it may be difficult to demonstrate mathematically and in detail the economic justificaion for such action, any road that has a surplus of heavy relayer rail should give serious consideration to its use on branch lines of light traffic.

Because of the greater girder strength of the heavy sections, a wider tie spacing is permissible, so that a part of the first cost of the heavy rail can be offset by the smaller number of ties required. If the tie plates which supported the rail during its main line service are applied on the branch line the ties should last longer. These factors, together with the smaller amount of surfacing and other maintenance, should result in a definite reduction in maintenance costs that will continue during the life of the rail, which is to say, indefinitely.

Another outlet which will absorb to advantage, large quantities of the accumulated rail, can be created by using the heavy sections in yards, on engine terminal tracks, on passing sidings and other frequently used side tracks, particularly those over which road engines must be operated. If the road is in a mining district, it may be advantageous to relay some or all of the mine tracks. Mine tracks are notoriously the most poorly maintained facilities on many roads, although frequently they originate a large tonnage of the heaviest loading.

The Kansas City Southern recently completed an extended investigation of the economic weight of rail for its main lines. Although it is a line of light traffic, as compared with many roads, it reached the surprising conclusion that rail weighing 137 lb. to the yard would be the most economical for its use. On the same basis there are few branch lines upon which it would not be economical to install relayer rail of the weights commonly being released from main line service.

Efflorescence in Brickwork

How can efflorescence on brickwork be prevented or minimized? When it occurs, what means can be employed to remove it?

Water-Tight Construction Is Most Effective

By Hugo Filippi
District Engineer, The Common Brick Manufacturers Association of America, Chicago

Efflorescence, sometimes called saltpeter, scum and white wash, is a salt deposit which frequently forms on the face of masonry. It is common to concrete, limestone, sandstone, brick and even to such denser materials as granites and marbles. The most common forms are the calcium and magnesium sulphates, with the first predominating.

The condition precedent to and necessary for the development of efflorescence is a wet or damp wall. This condition is brought about in many ways. If the top of a wall is not protected properly during construction, rain or snow water may enter in large quantities, saturate the brickwork and dissolve the salts found in the bricks and mortar. This solution is then drawn to the face of the brickwork by action where the salts crystallize by evaporation and the visible deposit takes place.

Field observations, made after long periods of soaking rains, prove that the bricks in a wall seldom absorb moisture to a depth greater than ½ in. On the other hand, the mortar immediately adjacent to such bricks has, at the same time, been found to be saturated to a depth varying from 1½ in. to the full width of the brick, from which it follows that the mortar joints and not the bricks, are generally the primary cause of the trouble.

The only positive method of preventing efflorescence on brick masonry is to see that the work is built solidly. The thickness of mortar joints should be reduced to a workable minimum. Belt courses and all other trim, should be designed with generous washes and undercut drips so that local collection of water will not take place.

In addition to these precautions, a damp-proofing course of asphalt mastic, pitch or of thick prepared roofing should be introduced at or near the ground line to prevent the absorption of moisture from the soil. The parapet walls should be given the closest possible attention during construction. The joints must be as thin as practicable with all joints completely filled. On top of the masonry, directly under the coping, there should be laid a damp-proofing course consisting of either a heavy non-corrosive metal, a four or five-ply course of prepared roofing

or a mastic compound not less than ¼ in. thick. The coping pieces should be bedded firmly in a good mortar on this damp-proofing course. The coping material itself should be dense and impervious to the passage of moisture.

If efflorescence appears shortly after a building has been completed, an investigation should be made to determine the cause. If all of the brickwork appears tight, the efflorescence is probably due to construction water, and should disappear in a few months. If, on the other hand, the efflorescence continues to increase, the brickwork should be more carefully checked over for nail holes, faulty joints, leaks around openings, copings, belt courses, etc., and the defective work should be rebuilt or pointed up immediately.

To remove efflorescence from older buildings, the affected wall surface should be washed down with a 10 per cent solution of muriatic acid and water and scrubbed with a fibre brush. This application should be followed immediately by a thorough washing with clear water. It may be necessary to repeat this operation several times to secure satisfactory results. This process will not produce lasting results, however, unless the leaks which caused the efflorescence have been completely sealed before the washing down operation is undertaken. In this connection, particular attention should also be paid to defective or missing downspouts and gutters and to the roof flashing and counterflashing, as faulty drainage and roof protection are positive causes of efflorescence and must be maintained in a good condition. Many of the glaring examples of efflorescence can be traced directly to one or both of the last mentioned causes.

Joints Should Be Made Water Repellant

By Engineer of Buildings

Efflorescence may occur on the exposed surface of any masonry, but is most noticeable on brickwork. Its presence always indicates moisture in the wall and this points to the action that is necessary to prevent its appearance. The methods employed to do this should begin with the design of the structure and the selection of the materials to be used, and follow through the construction. If this is done, close attention to certain details of maintenance will practically eliminate the trouble.

None of the methods involved in either design, construction or maintenance requires a departure from good practice in other respects. In buildings where the occurrence of efflorescence is most troublesome and unsightly, watertight construction and damp proofing are important to prevent disintegration of the materials and will do much to prevent efflorescence. Since water ordinarily penetrates a wall through the mortar joints rather than through the brick, the mortar should be made water repellant. This can be done by the addition of two per cent by weight of calcium stearate or ammonium stearate to either the cement, the lime or the mixture of the two. This mortar should be used throughout and special care should be given to the construction of the joints in copings, window sills and parapet walls. When the joints are repointed, the same addition to the mortar should be made.

The copings should be made impervious to water; parapet walls should be flashed in such a manner that the flashing is carried clear through the wall well above the roof level; the inside of this wall should be waterproofed, and flashing should be employed at all other points where seepage is likely to occur. Drips should be provided on copings, cornices and window sills and joints should be eliminated where practicable, or reduced to a minimum. If brick sills are employed, metal flashing which is provided with drips should be placed under them.

Vertical joints should be kept to a minimum in both number and length. It is especially important that the mortar in such joints be water repellant. During construction, protect the walls to prevent rain or snow from getting in, and keep the brick, tile and stone trim dry at all times before use. After the building is completed, frequent inspections should be made to insure that gutters and downspouts are in good condition and that no leaks have developed.

About the only practicable method of removing efflorescence, once it occurs, is to wash the surface down with a weak (about 10 per cent) solution of hydrochloric acid, at the same time scrubbing it briskly with a stiff brush, after which it should be washed thoroughly with clear water. The first scrubing may not remove all of the deposit, in which case the scrubbing should be repeated until it is all removed.

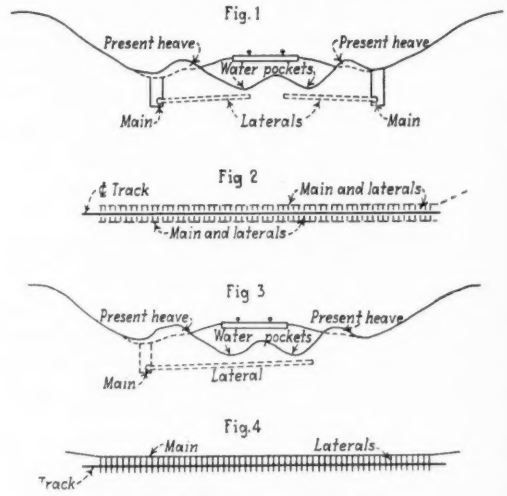
Lateral Drains in Cuts

Where lateral drains are laid under the track in wet cuts, how far apart should they be placed? Should they all drain to the same side of the cut or should the alternate laterals drain to opposite sides?

Depends on Conditions in the Cuts

By H. M. Long
Division Engineer, Chicago, Rock Island & Pacific, Herington, Kan.

The intervals between lateral drains in wet cuts depends entirely on the number of soft spots in each particular cut. The primary purpose of these laterals is to drain all of the water from the pockets as quickly as possible. Keeping this fundamental requirement in mind, it is readily seen that where the



Two Methods of Tiling Cuts

water pockets are scattered throughout a wet cut, there is not need for so many laterals as are necessary in a cut which contains a larger number of water pockets.

My own experience in the installation of drain tile has taught me that there should be a minimum of two laterals to the rail length across the affected area. If the soft condition exists continuously through the cut, more laterals should be installed at

closer intervals. The location of the additional laterals should be determined by test pits which should be excavated at the ends of the ties. This gives certain information as to the extent and depth of the waer pockets and enables one to determine definitely the number of additional drains which should be installed.

In my opinion alternate laterals should drain into mains on opposite sides of the cut, as shown in Figs. 1 and 2. While it is generally conceded that the primary purpose of the mains is to collect and carry away the water received from the laterals, there is no doubt that, if properly laid, they also function to dispose of considerable surface water from the side ditches, as well as seepage from the sides of the cut and roadbed, thus assisting to keep the roadbed dry.

Some engineers prefer the use of a single main laid on one side of the track, to which all laterals are led. This method is shown in Figs. 3 and 4. In view of the desirability of removing all of the water from the cut, I believe that it is better to install mains on both sides. The cost of the additional main is little, if any, greater than the cost of extending the laterals clear across the track, as is necessary with this method. The advantages, however, are sufficient to warrant its installation even if the cost is materially more.

Laterals Should Drain to One Side of Cut

By A. A. Miller
Engineer Maintenance of Way, Missouri Pacific, St. Louis, Mo.

The distance between laterals will be determined very largely by the result of the exploration which is made when the main drain tile is laid, following the digging of test pits, which should always precede the fixing of the grade line of the main drain. The porosity of the soil encountered, the configuration of the top of the sub-grade where it meets the ballast line, the amount of water encountered and the distance which the lateral can be reasonably expected to pull the water, all enter into the answer, which, after all, must be determined on the ground according to the judgment and experience of the engineer or inspector who is in charge of the work. In general, this distance will vary from 11 ft. to 16½ ft., being determined in some measure by the desirability of keeping the laterals away from the present location of the joints in the rail. Our experience indicates that it is very undesirable to have a trench directly under a joint. For this reason, we try to have two or three laterals to the rail length, placing them so that none will come under the joint.

Where roadbed tile drains are installed under a single track, all laterals should be drained to the same side. The success or failure of any roadbed tile drainage system lies in the care and judgment exercised in locating and laying the laterals. In our opinion, the main tile does a minimum amount of good, except to act as an outlet for the laterals, which really take care of the water in the roadbed. If properly designed, the main drain will carry all of the water which the lateral can bring to it. The money which would otherwise be spent on a second main, will give, in our judgment, a better return if applied to additional laterals laid closer together.

Almost invariably, we have found that we can get a better outlet on one side of the main track than on the other, so that on that side we can get a steeper grade on the main tile. A serious disadvantage of having laterals drain to opposite sides of the main track, is that this arrangement makes it difficult to keep the track in good cross level immediately following the installation of the system, so that high speed traffic begins to roll when it hits the new work. If the laterals extend entirely across the track, both sides of the track go down together so that any inequalities of surface are equalized on both sides, or nearly so. This disadvantage can be minimized somewhat, however, by carefully tamping the back fill of the lateral trench. We have had excellent success with our roadbed tile drainage installed according to these principles. In only a very few places have we failed to secure complete and satisfactory results.

If two or more tracks traverse the cut, it is then necessary to use two mains, one on either side of the tracks, which, in effect, requires the installation of two independent drainage systems.

When installing a drainage system in wet cuts, it is important that the laterals be placed from 12 in. to 18 in. below the bottom of the lowest point in the water pocket, and the width of the lateral ditch should never be less than 18 in.

Highway Bridge Floor

What is the most satisfactory design of a wood floor for an overhead highway bridge carrying a heavy automobile traffic?

Wood Wearing Surface Should Be Protected

By R. H. Gilkey
Division Engineer, Central of Georgia, Savannah, Ga.

Our experience indicates that the most satisfactory as well as the most economical design of a wood floor for a highway bridge carrying heavy automobile traffic consists of 3-in. by 10-in., rough creosoted plank, well nailed to a sufficient number of floor beams to make it rigid. A coating of asphalt mixed with crushed stone or slag, about three inches thick, should then be applied and rolled smooth. Guard rails on each side, 3 in. by 10 in., are sufficient to prevent the crawling of the wearing surface. This design is very satisfactory from the traveler's point of view and assures long service life for the floor. Wood wearing surfaces have short service life and cannot be kept smooth where the traffic is heavy.

One That Will Ride Smoothly and Last Long

By S. F. Grear
Assistant Engineer of Bridges, Illinois Central, Chicago

Floors on overhead highway bridges should have stability, smooth riding qualities and long life. Where a wood floor is to be maintained, if the span-length will permit, I would recommend wooden stringers which have been given a light treatment with creosote or some other preservative which will not render them too liable to fire. Structures over railway tracks are subject to smoke and gases so that steel stringers deteriorate rapidly. Timber stringers are not damaged by smoke and should last almost indefinitely, if decay can be prevented. I do not consider concrete a proper material for stringers, particularly if carried on wooden supports, since, if deterioration sets in or they are damaged, there is no satisfactory way of making repairs.

The deck planking should be a single layer of 4-in. by 10-in. or 4-in. by 12-in. timbers, surfaced top and bottom and give a uniform thickness, thus insuring a smooth top surface. These planks should be given the same treatment as the stringers. They should be laid at

right angles to the center line of the bridge, and should be well spiked to the stringers.

If the traffic is heavy, as suggested in the question, the wooden bearing surface will have a comparatively short life. For this reason, it should be covered with asphalt planking or asphalt blocks which have been manufactured under high pressure. At present, manufacturers recommend a minimum thickness of 1½ in. for the asphalt wearing surface, but I am hopeful that further experience will show that a thinner material will be satisfactory. Asphalt planking should be laid longitudinally with the bridge so that the wear of the traffic does not necessitate the renewal of the entire surface.

Cleaning Water Pipes

Under what conditions is it advisable to clean rather than replace incrusted pipe lines? What methods of cleaning can be employed?

Depends on Condition and Size of Pipe

By R. N. Foster
Water Engineer, Wabash, Decatur, Ill.

The factors governing the choice between cleaning or replacing an incrusted pipe line are comparative cost; the age of the pipe line in question and the probable service life remaining; the condition of the line, particularly with reference to corrosion, leaking joints, etc.; its location, as regards the ease or difficulty with which repairs can be made; and the degree of obsolescence. In general, it is advisable to clean a line of pipe rather than to replace it when it is in a good state of preservation and of ample size to meet present and probable future demands.

The two most common methods of cleaning incrusted pipe are by the use of muriatic acid and by means of mechanical equipment specially designed for this purpose. In the former, the acid is usually employed for lines ranging up to one-half or three-fourths of a mile in length, or on lines which contain a large number of elbows and cross connections. Again, this method is often more advantageous for lines that are not readily accessible because of the depth to which they were laid.

The mechanical equipment, or "porcupine" as the cleaning instrument itself is often termed, is usually employed on lines that are comparatively straight, free from cross connections, and are more than three-fourths of a mile long. It is desirable that lines upon which this method is employed be laid shallow enough so that they can be uncovered at frequent intervals without excessive cost. This method is also adapted for use where the incrustation is of such a character that the acid will not readily attack and remove it. This occurs when the obstruction to the flow consists largely of mud and silt, some varieties of sand and iron oxide.

Desirable if Cleaning Cost Less than Renewal

By F. T. Beckett
District Engineer, Chicago, Rock Island & Pacific, El Reno, Okla.

Incrusted pipe lines should be cleaned when the cost of doing so is less than that of renewal, which is normally the case in cast iron pipes. When incrusted with a precipitate soluble in muriatic acid, a pipe line can be cleaned cheaply through the use of this material, provided the pipe line can be taken out of service for a short period. A temporary line of smaller diameter can often be laid to permit the permanent line to be taken out of service if the amount of water used is very large and the storage capacity is not sufficient to permit shutting it off for the required period. If the pipe is 4 in. in diameter or larger, periods as long as 24 hr. may be necessary to complete the cleaning, depending on the amount of incrustation. An inhibitor should be used to prevent etching of the pipe or damage to valves and other connections.

If the pipe is incrusted or filled with mud, sand or algæ, it may be cleaned with dragline cutters or pressure-operated rotating cutters. The commercial dragline cutters are pulled through the pipe by means of a cable attached to the cutter, using a winch to give the necessary pull. The rotating cutter, however, is placed in the line and forced through it by water pressure back of it. Pipe that has been taken up and needs to be cleaned before it can be used again may be cleaned by the use of a spiral-shaped boring tool attached to an electric or air motor, in a manner similar to a cylinder boring bar. In this operation, the pipe is clamped to a rack and the boring bar is forced through it, using air to blow the cuttings clear of the pipe. No damage is done to the interior lining of cast iron pipe if properly designed tools are used.

When pipe that has been removed from the ground is to be cleaned, it is desirable that the incrustation be permitted to air slack or dry out for a short period before the pipe is bored or cleaned.

Short lengths of small diameter pipe and fittings can be cleaned better after they are removed from the line, either by the use of acid or by drilling them out and then finishing the job with the acid.

Cleaning Is Usually Advisable

By C. R. Knowles
Superintendent Water Service, Illinois Central, Chicago

The question of cleaning an incrusted pipe line, as compared with the laying of a new line to replace it, is largely one of economics. Invariably incrusted lines can be cleaned at a lower cost than that of constructing a new pipe line. Other factors may be involved, however, such as convenience, accessibility of the line, its probable remaining service life and the time involved in doing the work.

The line under consideration may be of such importance that it cannot be taken out of service for a sufficient length of time to permit the cleaning to be done. Such cases are extremely rare, however, since the line can be cleaned by mechanical methods by taking it out of service for only a few hours at a time. It is usually possible to select such intervals at times when this will not interfere with other operations. On the other hand, if chemicals are used for cleaning it may be necessary to keep the line out of service for periods ranging from 12 to 24 hours.

The cleaning of pipe lines is particularly desirable where the lines are laid in inaccessible places or where they would be difficult to renew, as for example, under busy tracks, or buildings, across streams or where it is necessary to lay them at great depth. The time involved in cleaning pipe lines is much less than that required to lay a new line, which is often the deciding factor regardless of any question of economy.

Three methods are followed in cleaning pipe lines: (1) By hand; (2) by mechanical means; and (3) by the use of chemicals. Pipe can be cleaned by hand only when the deposit is comparatively soft. Even

then this method is adapted only for short lines, since the procedure consists simply of scraping the deposit from the interior of the pipe.

Mechanical cleaning, on the other hand, is followed extensively on both railway and municipal water lines. The process in this instance consists of opening the pipe line and inserting a cleaning machine which is forced through the pipe by water pressure, the water carrying the deposit which is scraped off ahead of the cutting machine. Where the incrustation is heavy or extremely hard, it is sometimes necessary to attach a cable to the cleaning instrument in order to supplement the action of the water pressure by driving it through the pipe.

Pipe lines are often cleaned with hydrochloric acid, either by introducing the acid and allowing it to remain quietly in the pipe line for a sufficient time or by circulating it through the pipe by means of a pump. The latter method reduces the time required for the operation and is also more economical than the former, since the circulation of the acid makes its action more effective, while it is often practicable to reclaim and reuse it. The surging process is used on extremely long lines by means of a pump located at each end of the section being cleaned. Cleaning with acid is particularly desirable around treating plants, enginehouses, and elsewhere where the lines are comparatively short and there are numerous elbows, branches or cross connections.

Mechanical cleaning is better adapted for lines of large diameter or of considerable length because of the time involved and the quantity of acid required. When using the acid, it is necessary to employ some form of inhibitor in order to prevent corrosion of the piping, the valves and the pumps.

It is of more than passing interest that the first cleaning of water mains of which there is any record occurred on the Illinois Central in 1867. At that time 10,000 ft. of 4-in. pipe at Centralia, Ill., laid in 1855, was taken up, cleaned by hand and relaid.

Caring for Tools

What practical methods can a track foreman employ to keep his tools in good condition?

Are Kept in Condition at Division Shop

By A. M. Clough

Supervisor of Track, New York Central, Batavia, N. Y.

Our system of handling tools leaves very little for the foreman to do other than to watch carefully to insure that no dull or badly worn tools are used. At my headquarters, I employ a blacksmith and a helper, the former being an expert toolmaker of long experience. Worn or damaged tools are sent in currently by local trains and a good tool is returned immediately for every old one received. Tools that are beyond repair are turned in to the stores department after inspection by myself or the assistant supervisor, and are replaced with new tools. Every section and extra gang is provided with a grindstone or portable grinder for sharpening such tools as can be cared for locally.

We do not run a supply train, but receive supplies currently as ordered. By handling the matter as I have outlined, we are able to keep our tools in first class condition at all times and with the close supervision that is given we never find an accumulation of either new or worn tools at gang headquarters. The toolmaker I employ is not kept busy with my work, and for this reason cares in the same manner for the tools on parts of two adjoining divisions.

Foremen Should Keep Close Check on Tools

By R. H. Gilkey

Division Engineer, Central of Georgia, Savannah, Ga.

Good tools are essential to good work. Every tool house should have posted in a prominent place a standard list of the tools that are required on that section, which should be prepared in accordance with the character of the work to be done, the size of the gang and the kind of labor. The complement of tools on hand should be checked against this list periodically, and any worn or damaged tools should be exchanged for good tools. Any tools that are lacking should be secured as soon as practicable. The foreman should keep his tools sharp and forbid the use of dull, worn or damaged equipment. The checking of the list and the work of sharpening can often be done on rainy days, and should be done by or under the direct supervision of the foreman.

An Anvil and Forge Should Be Provided

By W. G. Morgan

Division Engineer, Kansas City Southern, Texarkana, Texas

On the Kansas City Southern, the stores department handles the repairing and sharpening of the tools that are returned as unfit for use by the maintenance forces. Supply cars are operated at intervals of 60 days, at which time foremen are allowed to exchange their worn or bad order tools for new or reconditioned ones. Every track foreman is provided with a portable tool grinder for the purpose of keeping his tools sharp, but this does not seem sufficient in the case of picks.

In my opinion every foreman should, in addition, be provided with a forge and a small anvil, with which he can keep all of his tools sharp. My observation is that during the tie-renewal season, particularly when the ties are inserted in gravel ballast, it is almost necessary to sharpen picks at least once a week, and to do this an anvil and forge are necessary.

Educating the Men in the Use of Tools Is Fundamental

By Roy Hahn

Clerk to Master Carpenter, Seaboard Air Line, Tampa, Fla.

Speaking from past experience as a track foreman, the most practical method for keeping tools in good condition is to organize the gang properly and educate the men to use the tools for the purposes for which they are intended. This is the first and fundamental step in preventing abuse of tool equipment as well as in eliminating causes of accidents.

All tools that are to be used should be inspected every day before leaving the car house. This work should not be delegated, but should be done by the foreman himself, since he should know personally that all tools are in proper condition for service. Any tools that are dull or defective should be discarded and later sharpened or exchanged. Usually there are plenty of rainy days to provide ample time for sharpening, replacing broken handles or making other repairs that can be made locally.

If every tool is used only for the purpose for which it is intended, it will remain in good condition for a longer period, and much of the trouble with dull and defective tools will be eliminated. Claw bars should

be used for pulling spikes and for no other purpose. Lining bars are for lining track and should never be used for lifting the track or for "nipping" the rail. Many foremen allow their men to use shovels instead of tie tongs for pulling in ties. This list could be extended indefinitely but these examples are sufficient.

The use of dull or defective tools invariably results in unsatisfactory work and is responsible for many personal injuries as well as added costs for the work done. No first class track foreman will permit the use of such tools and others should not be allowed to do so, since there is no difficulty in securing an ample supply of tools that are in good condition.

Curing Creosoted Ties

How long an interval should elapse after treatment before creosoted ties are inserted in the track? Why?

Seasoning Increases the Strength

By C. S. Burt
Superintendent Ties and Treatment, Illinois Central, Grenada, Miss.

Since our lines penetrate the southern pine territory, about 60 per cent of our requirements are met by the use of yellow pine, the remainder being red oak, white oak and other hardwoods. All of our ties are treated by the Reuping process with a retention of 5½ lb. to 6 lb. of creosote. In forcing the preservative into the timber, the wood fibres are softened, so that a period of curing or seasoning after treatment is desirable. Wood has its greatest strength when the contained moisture is at a minimum. The liquid preservative has the same effect in this respect as moisture.

For this reason, pine ties should be seasoned a minimum of 30 days during the late spring and summer months and not less than 45 to 60 days in the fall and winter. Oak and other hardwoods do not require quite as long a period of curing and I believe that half the time given for pine ties will prove satisfactory.

Should Cure Not Less Than 60 Days

By Engineer Maintenance of Way

An interval of not less than 60 days should elapse after treatment before creosoted ties are inserted in the track, and a 90-day interval would be more satisfactory. I am aware that this is not always practicable since maintenance or construction requirements, the difficulty sometimes experienced in securing the authorized quota of properly seasoned ties and other conditions often make it impossible to allow this interval between treatment and use. Every reasonable effort should be made, however, to attain this objective wherever possible.

There are definite reasons for prescribing this interval. In the first place, freshly creosoted ties are slippery and difficult to handle because of the surface oil. The fresh creosote blisters the skin wherever it comes in contact with it and is quite likely to damage the clothing of the men. In addition, it is highly inflammable and, therefore, creates a certain amount of fire risk. Another feature which I have observed is that when freshly creosoted ties are inserted in the finer grades of ballast, such as gravel, chatts, cinders or burnt gumbo, the surface oil, and probably some of that held in the outer layers of the wood, is absorbed by the ballast.

On our road it is customary to distribute a carload of freshly creosoted ties on each section about September 1, after the ties for the current season have been applied. These ties, which are credited to the quota for the succeeding year, are unloaded at some convenient point at the station to be held as an emergency supply and, unless used for emergency purposes, are applied in the main track and sidings, and as far beyond as they will reach, during the following year. All other ties are held in storage at the plant for 60 days or more.

Should Be Post-Treatment Curing

By General Roadmaster

While we have been using treated ties for many years, our experience with creosoted ties is not so extensive as that of many roads. We have observed several interesting things, however, since we began to creosote our ties extensively. So far as possible we endeavor to secure our tie timber on our own lines, and for this reason use a wide range of hardwoods and softwoods.

We have found that some of these woods show a tendency to crush under the tie plate when inserted in the track immediately after treatment. We are not yet sure that this is not an inherent defect of the timber itself, but, since it does not occur in the same ties when they are used untreated, we are inclined to ascribe the trouble to the fact that the ties that have shown this tendency were supplied without a sufficient interval for post-treatment curing. Whatever may be the cause of this particular trouble, I am of the opinion that creosoted ties should be allowed to cure for 60 to 90 days, preferably at the treating yard, before they are shipped out. If this is done they are much easier to handle, the excess oil on the surface is given an opportunity to dry and the surface fibres of the wood harden and are, therefore, better able to bear the loads that are imposed upon them.

Renewing Caps

Is it practicable to renew a cap on a ballast-deck trestle without removing any of the deck. If so, how?

Describes a Unique Method of Replacing Caps

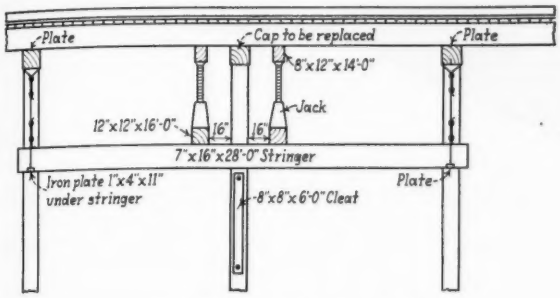
By P. Glynn
Division Engineer, Illinois Central, Louisville, Ky.

Some time ago we found it necessary to remove some caps from a ballast deck trestle where it was not convenient to set up temporary bents and F. G. Morgan, one of our bridge and building foremen, devised a method of doing the work which is adapted for all such trestles.

In this method wooden stringers are suspended longitudinally on each side of the bridge by means of a ¾-in. steel cable looped over the caps adjacent to the bent from which the defective cap is to be removed. At the points of suspension, steel plates are placed to prevent the cable from cutting into the timbers. A reinforced cleat, 8 in. by 6 in., is bolted to the outside batter pile of the bent to be repaired, so that the top is about four inches below the bottom of the suspended stringer. The purpose of this cleat is to take up the deflection of the stringer and the stretch in the cables when the load is applied. Wedges can be used between the cleat and stringer if this becomes necessary.

Timbers, 12 in. by 12 in. by 16 ft., to support the jacks are placed on the stringers, parallel to the defective cap, leaving at least 16 in. clearance outside the bent. The new cap is placed in this space on one side of the bent. Four jacks are then set, two on each of the supporting timbers under the outside stringers of the bridge deck, and a timber, 8 in. by 12 in. by 14 ft., is placed on top of the jacks, which are then screwed up

to a snug fit. Next, the ballast is opened up and one floor board is removed to give access to the drift bolts, which are pulled. The stringers are then jacked up just enough to allow the cap to be raised one inch, which is sufficient to permit the drift bolts between the cap and piles to be sawed off. The cap is slid over and



How the Jacks Are Supported

dropped into the clearance space opposite the one in which the new cap rests.

The new cap is raised by means of tackle blocks and ¾-in. lines, one of which is suspended at each end of the cap from a timber, 3 in. by 10 in. by 16 ft., which is laid over the top of one rail with its end slipped under the opposite rail. The drift bolts are then replaced by driving long bolts which extend through the stringers and cap into the piles. The force required in this operation is one foreman and five men, including two men to flag. Caps have been replaced on a bridge 29 ft. high at a cost of $60. On low bridges it may be preferable to set up temporary bents, but where this is not practicable the method which has been described is the best and most economical of which I know, and creates the least disturbance to the deck of the bridge.

Renewal Without Removing Deck Is Practicable

By R. H. Gilkey

Division Engineer, Central of Georgia, Savannah, Ga.

This is an extremely practical question, since it refers to a problem that many maintenance officers must meet and solve. It is practicable to renew caps on ballast deck trestles without removing the deck. The procedure is as follows: The cap to be removed is raised about two inches and the drift bolts are sawed off. During this time the stringers are supported by temporary caps placed each side of the bent involved in the repairs and far enough back to give the necessary clearance. The cap and stringers are raised by using three jacks on each side of the bent. After the drift bolts are cut, the old cap is slid out and the new cap is substituted. The stringers are then lowered, the ballast is opened up over the cap and new drift bolts are driven. We have applied more than 30 caps to a single trestle in this manner during a period of several years.

Depends on the Design of the Trestle

By C. S. Heritage

Bridge Engineer, Kansas City Southern, Kansas City, Mo.

The practicability of renewing caps on ballast-deck trestles without removing the deck depends somewhat on the design of the trestle. Our structures of this type have the caps attached to the piles and the stringers to the caps by means of drift bolts. This construction necessitates the removal of one or more deck planks in order to remove the drift bolts in the stringers. It is possible to modify this design, however, so that caps will be attached to the piles by straps or scab plates. In the same way, clip angles or special castings can be employed for fastening the cap and stringers together.

It would be possible to replace a cap in a trestle having drift bolt fastenings without removing any of the deck. The procedure in this case would be to shove up the stringers, cut off all of the drift bolts and, after the new cap is in place, make the attachments as already suggested.

I am sure the discussion of this question will be of considerable interest in determining whether the usual method of fastening trestle timbers together is the best for the purpose. We have been using creosoted ballast-deck trestles for 15 years, but, so far, have not found it necessary to change out any of the caps.

Renewal Without Disturbing Deck Practicable

By W. J. Howse

Bridge and Building Foreman, New Orleans & North Eastern, Poplarville, Miss.

It is entirely practicable to renew caps on ballast-deck trestles without removing any of the deck timbers. My plan of doing this is to prepare a substantial jacking foundation on each side of the bent affected, leaving sufficient clearance so as not to hamper the work. Two 35-ton jacks are used on each side of the bent to lift the stringers which form the deck. After the deck has been raised a sufficient amount to fully clear the cap, the drift bolts, if there are any, are cut with a hacksaw. The cap is then jacked up and the drift bolts holding it to the piles are cut in the same manner. Next a 2-in. by 8-in. timber is nailed to the bent about 3 in. below the bottom of the cap, a 1-in. rope is passed around this timber with a winch turn and fastened to the cap at its middle point. The cap can then be slid off the piles and lowered to the ground. The new cap is then swung from the top of the deck in the usual manner and set into position. It is fastened to the piles with drift bolts and the deck stringers are fastened in the usual way.

If the ground is of such character that a jacking foundation is not feasible or if the work must be done over water, the jacking foundation is prepared by fastening timbers to the bent from which the cap is to be removed and to the adjacent bents.

It Is Difficult, but Can Be Done

By Roy Hahn

Clerk to Master Carpenter, Seaboard Air Line, Tampa, Fla.

Although somewhat difficult and more costly, as compared with renewing caps on open deck trestles, it is entirely practicable to make such renewals on ballast-deck structures without removing any part of the deck. A method which has been used with success requires a suitable jacking foundation near the bent containing the defective cap. When this has been prepared, set jacks of sufficient capacity to lift the deck of the bridge, placing them so as to allow ample clearance on each side of the bent. Over the jacks, place 12-in. by 12-in. timbers to insure that all stringers will be raised together, and raise the jacks to a snug fit.

Before jacking is commenced, a chain should be looped around the deck near the bent and tightened to prevent the spreading of the stringers and the possibility of ballast getting between them. The ballast is then opened up directly over the cap and all drift bolts drawn. The jacks are lifted and the old cap removed. The new cap is placed and the deck is lowered, after which the drift bolts are redriven of such length as to reach through the stringers and cap into the piles.

New And Improved Devices

U. S. Drills Improved

THE United States Electrical Tool Company, Cincinnati, Ohio, is now equipping its U. S. ¼, 5/16 and ⅜-in. portable electric drills and also its No. 1 and No. 2 sizes of screw drivers, valve grinders and tappers, with Bohnalite metal housings. It is claimed that this metal is much stronger than aluminum, and, therefore, that these tools withstand rough handling and hard service better than before.

One of the Drills, with One Side of the Handle and the End of the Housing Removed

The portable electric drills have also been redesigned to permit one side of the handle and the end of the housing to be removed in one piece. This design renders the switch, wiring and commutator more easily accessible when servicing becomes necessary. It is said that the brushes are quickly removed and replaced and that the new lines of the handle give increased gripping ease, besides improving the appearance of the drills appreciably.

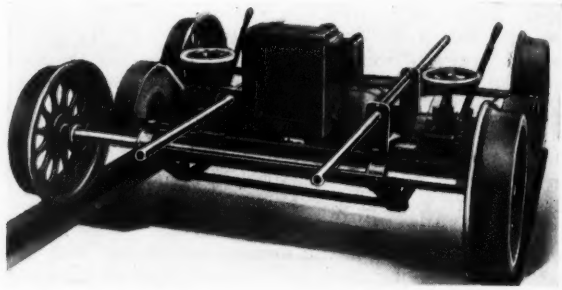
A Track Grinder in Two Models

TWO NEW track grinding machines, designated as Models P-2 and P-3, have been developed by the Railway Track-Work Company, Philadelphia, Pa. These machines are designed for use on open track to remove surplus metal which has been produced by arc welding to build up cupped joints.

Model P-2 is mounted on a four-wheel frame and is equipped with two grinding heads, one over each rail, which operate independent of each other. A throwout switch allows one grinder to remain idle during the operation of the other. The grinding wheels are 12 in. in diameter, have 1½-in. faces, and are powered with a 3-hp. motor. This motor is controlled by an automatic starter with a push-button station for each unit, which is located within convenient reach of the operator. It is equipped with a flexible coupling and a helical gear drive which is enclosed entirely in a housing. The vertical adjustment or feed provided for each grinding wheel is regulated by a hand wheel which operates a worm through a feed gear.

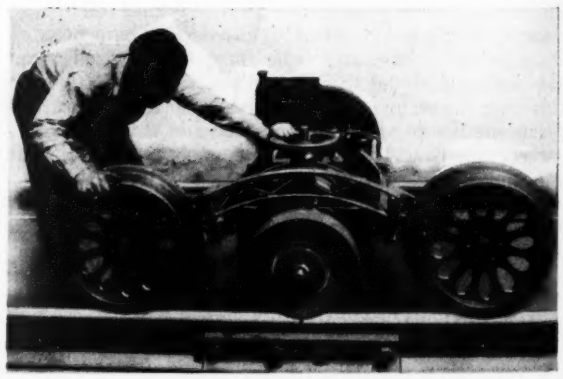
Each grinding wheel is adjusted laterally by a lever which permits sufficient movement of the wheel to grind both sides of the head of the rail. The axles of this machine run in ball bearings which, it is said, allow easy travel back and forth over the joint by turning one of the track wheels. For moving to and from the track, the grinder is equipped with a set of handles which may be extended longitudinally in either direction. This machine is 64 in. long and 22 in. high and weighs 800 lbs. complete, ready for service.

The design and construction of Model P-3, which



The Model P-2 Grinder Has Two Grinding Heads

has one grinder and only three wheels, is somewhat different from that of the two-grinder machine. The motor of this model is mounted on a steel frame which in turn moves vertically and laterally in another frame. A feed screw which is operated by a hand wheel provides vertical adjustment for the



Model P-3 Has One Grinding Head Which May Be Applied to Both Rails

grinding wheel. The grinding wheel spindle is engaged with the main drive shaft through spiral gears and the main shaft is connected with the motor shaft by a flexible chain coupling. A lever jack is provided at the center of the machine by means of which the grinder can be hoisted and turned to grind on the other rail. A 12-in. grinding wheel with a 1½-in.

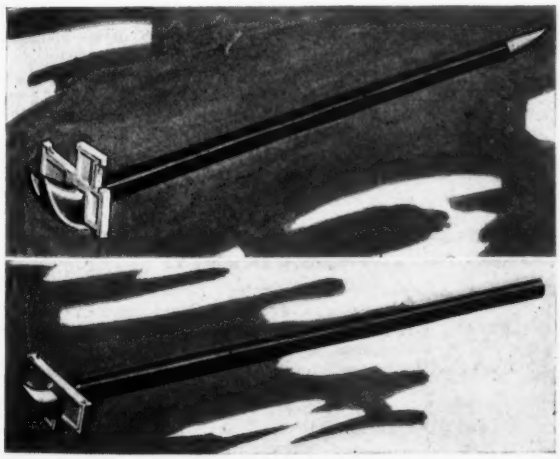
face is also used on this model. The wheel is made of Bakelite Bond and operates at 9,500 surface feet per minute. This machine weighs 500 lb. complete and the frame is constructed of steel castings.

Step Claw and Lift Bars

THE Clark Manufacturing Company, Philadelphia, Pa., is manufacturing clawbars and general utility lift bars which have a four-step heel that is intended to function as blocking in increasing the vertical lift of the bars. The four-step clawbar consists essentially of a claw head having a swivel fit in a five-foot bar of steel tubing, at the base of which is welded a three-step heel with legs of such length that it is possible to pull spikes through a straight vertical lift of seven inches.

In using the bar, the initial lift of the spike is secured directly on the heel of the clawbar head, following which the bar handle is rotated through a quarter turn to bring the lowest step of the three-step heel into working position. Successive quarter turns of the bar bring the higher steps into play, each change of step being accomplished without removing the claw grip on the spike. The upper end of the bar is fitted with a chisel point so that the bar may be used for a wide variety of lifting and prying operations. The principal purpose of the four-step clawbar is to facilitate the pulling of spikes and to overcome the bending of the spikes which occurs frequently with the use of the usual type of clawbar, unless temporary blocking of some kind is provided.

The four-step utility bar is constructed on the same principle as the four-step clawbar and differs essentially only in the shape of the lifting swivel head. With this bar, which is five feet long and weighs 16 lb., it is possible to make a 6-in vertical lift without auxiliary blocking.



Above—The Four-Step Clawbar
Below—The Four-Step Utility Bar

FIFTY YEARS AGO.—The Flint & Pere Marquette (now the Pere Marquette), extending from Monroe, Mich., to Ludington, 253 miles, with 40 miles of branches, was sold with all its rolling stock and buildings at East Saginaw, Mich., on August 18. Only one bid was made, and that for $1,000,000.—*Railway Age*, August 26, 1880.

WITH THE ASSOCIATIONS

American Railway Engineering Association

While there were a considerable number of meetings of special committees during August, only five of the regular standing committees had formal meetings during the month. The Committee on Railway Operation had a meeting at White Sulphur Springs, W. Va., on July 31 and August 1; the Committee on Ballast met at Montreal on August 1; the Committee on Water Service held a meeting in Chicago on August 5; the Committee on Economics of Railway Location met in Chicago on August 21; and the new Committee on Maintenance of Way Work Equipment held a meeting at Toronto on August 26. In addition to these regular meetings, representatives of the committees on Buildings, Masonry and Iron and Steel Structures held a joint meeting in Chicago on August 21 and 22 for the purpose of interviewing representatives of various companies engaged in the manufacture of waterproofing in connection with the work of these three committees in the developing of standards and specifications for waterproofing.

The Proceedings for 1929, embracing the largest number of pages ever published by the association under this title, are now being mailed.

The Roadmasters Association

Plans for the 48th annual convention which will be held at the Hotel Stevens, Chicago, on September 16-18, are now approaching completion and the interest that is being shown indicates that this convention will equal or exceed those of preceding years in attendance, interest and educational value of the program. The program for the convention is as follows:

(Chicago Daylight Saving Time—One hour ahead of Central Standard Time.)

Tuesday, September 16

10:00 a. m.—Convention called to order.
Invocation by A. M. Clough, past president; supervisor, N. Y. C., Batavia, N. Y.
10:15 a. m.—Opening address.
10:40 a. m.—Address by President E. E. Crowley, roadmaster, D. & H., Oneonta, N. Y.
Appointment of special committees.
11:00 a. m.—Report of Committee on the Equation of Track Mileage as a Basis for the Distribution of Forces, P. J. McAndrews, chairman; roadmaster, C. & N. W., Sterling, Ill.
12:30 p. m.—Adjournment.
2:00 p. m.—Address on Track Maintenance as Affected by Signal Operation, by J. A. Peabody, signal engineer, C. & N. W., Chicago.
2:45 p. m.—Report of Committee on Getting the Most from Labor-Saving Equipment, W. O. Frame, chairman; district engineer maintenance, C. B. & Q., Burlington, Iowa.
3:30 p. m.—Address on Looking Ahead in Maintenance of Way, by Lem Adams, general supervisor maintenance of way, U. P. Sys., Omaha, Neb.
4:30 p. m.—Adjournment to visit exhibit of Track Supply Association.

Wednesday, September 17

9:30 a. m.—Report of Committee on the Division of Work Between Section and Extra Gangs, R. L. Sims, chairman; district engineer maintenance of way, C. B. & Q., Galesburg, Ill.
10:30 a. m.—Address on the Method and Organization for

Laying Rail on the Pennsylvania Railroad, by R. W. E. Bowler, division engineer, Pennsylvania, Pittsburgh, Pa.

11:30 a. m.—Address on Safety in Maintenance, by J. E. Long, superintendent of safety, D. & H., Albany, N. Y.

12:30 p. m.—Adjournment.

2:00 p. m.—Report of Committee on Recent Developments in Roadbed Drainage with Particular Reference to Multiple Tracks and Yards, J. A. Snyder, chairman; division engineer, M. C., Detroit, Mich.

3:00 p. m.—Address on European Track Construction and Maintenance, by J. V. Neubert, chief engineer maintenance of way, N. Y. C., New York.

4:00 p. m.—Adjournment to visit exhibit of Track Supply Association.

6:30 p. m.—Annual dinner of the Track Supply Association and the Roadmasters' Association.

Thursday, September 18

9:30 a. m.—Report of Committee on the Use of Motor Trucks in Track Work, O. J. Supernant, chairman; roadmaster, D. & H., Schenectady, N. Y.

10:30 a. m.—Business session.
Reports of officers and of committees.
Election of officers.
Selection of 1931 convention city.
New business.
Installation of officers.
Adjournment.

On Thursday afternoon the members will leave Chicago at 12:45 p. m. on a special train provided by the Chicago & Alton for Joliet, Ill., where they will visit the plants of the Illinois Steel Company and the American Steel & Wire Co. At the former plant they will be afforded opportunity to witness the production of steel and its conversion into bolts, spikes and angle bars, while at the latter plant they will be shown the manufacture of wire, nails and other fencing materials.

Track Supply Association

In addition to the 59 firms which were reported in the August issue as having arranged for space for the exhibit of their materials and equipment during the convention of the Roadmasters Association, one additional firm, the Enterprise Railway Equipment Company, Chicago, has also arranged to exhibit. In addition, six firms have taken membership in the association and will arrange for representatives to be present without exhibit as follows:

Electric Railweld Sales Corporation, Chicago.
Thomas A. Edison, Inc., Bloomfield, N. J.
National Malleable & Steel Castings Company, Cleveland, Ohio.
Verona Tool Works, Verona, Pa.
William Wharton Jr., & Co., Easton, Pa.
Wyoming Shovel Works, Wyoming, Pa.

The exhibit of the Track Supply Association will be presented in the main exhibit hall of the Stevens Hotel, immediately adjacent to the convention room, affording those attending the convention every opportunity to study the materials on display.

Bridge and Building Association

A meeting of the Executive committee was held at Chicago on Saturday, August 23, with President J. S. Huntoon, directors E. C. Neville and F. W. Hillman, Secretary Lichty and past-presidents Maro Johnson, C. R. Knowles, F. E. Weise, L. D. Hadwen and J. S. Robinson present. Five applications for membership were acted on favorably, bringing the total number of new members elected since the last convention to 32.

Plans for the next convention, which will be held at Louisville, Ky., on October 21-23, were discussed and the following program approved.

Tuesday, October 21

10:00 a. m.—Convention called to order.
Address by W. R. Cole, president, Louisville & Nashville, Louisville, Ky.
Address by the mayor of Louisville.

11:00 a. m.—Address by J. S. Huntoon, president, assistant bridge engineer, M. C., Detroit, Mich.
Report of the secretary-treasurer.

11:30 a. m.—Report of Committee on the Relative Advantages and Costs of Precast Concrete Crib Walls and Monolithic Walls, T. H. Strate, chairman, engineer track elevation, C. M. St. P. & P., Chicago.

2:00 p. m.—Report of Committee on Masonry Failures—Their Causes and Remedies, A. B. Scowden, chairman, general bridge inspector, B. & O., Cincinnati, Ohio.

3:00 p. m.—Report of Committee on Programming Bridge, Building and Water Service Work, E. C. Neville, chairman, bridge and building master, C. N. R., Toronto, Ont.

4:30 p. m.—Adjournment to visit exhibit of Bridge and Building Supply Men's Association.

6:30 p. m.—Buffet dinner jointly with Louisville Transportation Club.

7:30 p. m.—Address on Welding Structural Steel, by Albert Reichman, division engineer, American Bridge Company, Chicago.
Address on Strengthening of Bridge over Des Moines River by Welding Additional Flange Plates, by Walter Roof, bridge engineer, C. G. W., Chicago.

Wednesday, October 22

9:30 a. m.—Report of Committee on the Use of Power Tools and Equipment in Bridge and Building Work, R. D. Ransom, chairman, supervisor bridges and buildings, C. & N. W., Sioux City, Iowa.

10:30 a. m.—Report of Committee on Camp Cars and Their Equipment for Bridge and Building Crews, C. M. Burpee, chairman, engineer, purchasing department, D. & H., Albany, N. Y.

2:00 p. m.—Address by R. E. Simpson, general manager, Sou., Cincinnati, Ohio.
Report of Committee on the Inspection and Maintenance of Water Tanks and Their Appurtenances, E. H. Brown, chairman, supervisor bridges and buildings, N. P., Minneapolis, Minn.

3:00 p. m.—Report of Committee on the Modernizing of Station Buildings, F. H. Soothill, chairman, chief estimator, I. C., Chicago.

6:30 p. m.—Annual banquet.

Thursday, October 23

9:00 a. m.—Report of Committee on the Maintenance of Turntable and Drawbridge Machinery, A. E. Bechtelheimer, chairman, assistant bridge engineer, C. & N. W., Chicago.

10:00 a. m.—Closing business.
Election of officers.
Selection of meeting place.
Adjournment.

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 21-23, 1930, Louisville, Ky.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 59 East Van Buren street, Chicago. Next convention, March 10-12, 1931, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, Washington, D. C. Next convention, January 27-29, 1931, Philadelphia, Pa.

Bridge and Building Supply Men's Association—W. H. Lawrence, secretary, Johns-Manville Corporation, 41st street and Madison avenue, New York. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds, secretary, Syndicate Trust Building, St. Louis, Mo.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Manston street, Pittsburgh, Pa. Next convention, September 16-18, 1930, Chicago.

Track Supply Association—L. C. Ryan, secretary, Oxweld Railroad Service Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

RAILWAY NEWS BRIEFLY TOLD

Freight car loading for the week ended August 9 was 904,157 cars a decrease of 187,996 cars from the corresponding week of 1929 and 140,011 cars less than that of the same week in 1928. Revenue car loadings at stations in Canada for the same week totaled 61,272 cars, a decrease of 4,173 cars from the corresponding week of last year.

The New York Central has purchased 41 storage battery, oil-electric ("three-power") locomotives for switching service, 35 for use in New York and 6 in Chicago. The term "three-power" has been applied to this new form of locomotive because power for its operation may be obtained from a third rail, from engine and battery combined, or from the engine alone.

President Hoover has appointed Charles D. Mahaffie as a member of the Interstate Commerce Commission to fill the vacancy caused by the resignation of Thomas F. Woodlock, who let the commission to become contributing editor of the Wall Street Journal. Prior to his recent appointment, Mr. Mahaffie was director of the Bureau of Finance of the commission and is succeeded in that position by O. E. Sweet, assistant general solicitor, Bureau of Valuation.

The Baltimore & Ohio has equipped its night trains between New York and Washington, D. C., with day coaches especially fitted for the convenience of travelers not using the regular sleeping cars. Four of these cars have been placed in service. Each car has a smoking compartment for women at one end and one for men at the other and is equipped with a lunch counter, easily reclining seats and individual lights for those who desire to read.

The Interstate Commerce Commission has granted a certificate of convenience and necessity to the Mississippi Valley Barge Line authorizing it to operate as a common carrier by water on the Ohio and Mississippi rivers between Cincinnati, Ohio, and New Orleans, La., and intermediate points. The barge line is authorized to set up through rail-barge and rail-barge-rail rates on various commodities between points in central territory and points in southern and southwestern territory.

The Chicago & North Western and the Mamer Air Transport Company have established a rail-and-air schedule of 44 hr. 30 min. between Spokane, Wash., and New York, which is a reduction of 36 hr. 30 min. under all-rail schedules. The schedules involve air service between Spokane and St. Paul, Minn., train service between St. Paul and Milwaukee, Wis., air service between Milwaukee and Grand Rapids, Mich., in conjunction with the Kohler Aviation Company, and train service to New York over the Michigan Central and the New York Central.

Hourly earnings of all wage earners on Class I railways in the United States averaged slightly over 64 cents in the fourth quarter of 1929, while average weekly earnings were $31.80, according to information released by the National Industrial Conference Board, New York. Average earnings per hour of all train and engine service labor amounted to 92 cents and weekly earnings to $48.13; skilled shop labor received slightly less than 80 cents per hour and $37.62 per week. Earnings of unskilled shop labor were nearly 38 cents an hour and $17.97 a week.

Railroads acted promptly last month to administer relief in drought-stricken territories by reducing rates generally 50 per cent on hay, feed and water into the affected areas and on livestock out of the areas into more fortunate territory. This was done at the request of President Hoover and under a special authorization issued by the Interstate Commerce Commission which on August 9 issued a blanket order authorizing the roads to publish and charge rates without notice and without observing the usual rules governing the publication of tariffs.

Livestock Freight Rates— By Rail and by Truck

If livestock shippers in Illinois had shipped by rail the 1,115,606 head of livestock that they hauled to three markets in that state by truck in 1927, they would have saved $400,763, according to a study made by R. C. Ashby, associate chief in livestock marketing of the agricultural experiment station of the University of Illinois. On the basis of trucking and freight rates in effect in 1927, the apparent saving would have been 34.4 cents a head. Mr. Ashby says that the trucking rates to Peoria in 1927 averaged 2.8 to 3.5 times the rail rates on cattle and calves; to St. Louis the rates by truck were 2.3 to 4.2 times the rail rates; and to Chicago they averaged 2 to 8 times the rail rates.

Statistics recently issued by the Interstate Commerce Commission show that there were 6,496 persons killed and 76,995 injured on the railroads of the United States in 1929. These figures compare favorably with 6,509 killed and 85,561 injured in 1928 and 6,821 killed and 104,799 injured in 1927. The statistics show that there were 36 passengers killed in train accidents in 1929, while only 16 were killed in 1928 and 10 in 1927. However, this figure is only one more than half the average number of passengers killed in the four years prior to 1927. The total damage to cars, locomotives and roadway because of collisions and derailments was nearly $20,000,000 in 1929, which was about equal to the same figure for 1928.

Railway employment suffered a heavy reduction between May 15 and June 15, according to the preliminary statement of employment on Class 1 railways issued by the Interstate Commerce Commission. This statement showed that the number of railway employees as of the middle of June was 1,564,269, a decrease of 156,000 or 9.9 per cent as compared with June 15 a year ago, and a decrease of 37,216 as compared with May 15 of this year. This decrease is 3.31 per cent greater than the corresponding reduction for the month of May of this year, which was 6.59 per cent as compared with May of last year. The maintenance of way and structures group showed the greatest reduction, there having been 14.59 per cent less employees in this group on June 15, 1930, than on June 15, 1929.

The Boston & Maine has announced that industrial development projects involving the construction of new manufacturing and distributing plants to be served by its lines in eastern Massachusetts, at an aggregate cost of $2,250,000 and to employ 1,825 persons, have been contracted for within the past two weeks. This development involves four distinct projects comprising a total of almost 500,000 sq. ft. of floor space, and, in addition, the B. & M. has completed arrangements for the occupancy of a plant that has been vacant 10 years, by an industry which will move 10,000 tons of material annually through the Port of Boston. The Illinois Central has also reported that during the last 12 months 125 new industries have been established along its lines in 82 communities.

Construction News

Projects Contemplated

C. N. R.—Construction of steel and concrete bridges to replace existing timber bridges at Bethune st., Peterborough, Ont., and Eglinton ave., York, Ont., and elimination of grade crossing at Victoria Park ave., Toronto, Ont.

C. & N. W.—Construction of brick and steel inbound and outbound freight houses in Merchandise Mart, Chicago; 66 ft. by 250 ft., and 37 ft. by 386 ft., respectively.

G. T. W.—Construction of 85-car capacity paved team track yard, Detroit, Mich., to be equipped with traveling gantry crane.

Imperial Petroleum Exploration Co.—Has purchased 38-mile road between Homo, Tam., and Panuco, Ver. C., and will extend it from Panuco to El Higo, Ver. C., 32 miles.

Newfoundland—Construction new bridge across Crabbes river, 60 miles northeast of Port-aux-Basques, to replace bridge carried away by ice; steel and reinforced concrete with two 190-ft. through-truss spans.

Peoria, Ill.—Has petitioned Ill. Commerce Commission for separation of grades of C. B. & Q., C. R. I. & P. and P. & P. U. and Cedar st. in that city.

Texarkana & Ft. Smith—Construction new bridge over Little river, Morris Ferry, Ark., to include 3 deck plate-girder spans, each 84 ft. long and 1,100 ft. of pile trestle approaches.

Trinity Valley & Northern—Has applied to I. C. C. for authority to construct line, Cleveland, Tex., to Havens, 12 miles.

W. P.—Examiner O. D. Weed has recommended in proposed report to I. C. C. that the W. P. Cal. (a subsidiary of the W. P.) be allowed to construct a line between Redwood City, Cal., and Niles and Quint st. in San Francisco, Cal., 39 miles, to give road all-rail entrance into city. Cost $7,997,353 or less if road secures trackage rights over Dumbarton bridge of S. P. across San Francisco bay.

Approved by Commissions

C. P. R.—Bd. of Ry. Comm'rs of Can. has approved proposed location for Wolfe's Cove branch at Quebec, Que., and for the Ile Perrot branch extending 7.5 miles southeasterly from a point near Vaudreuil, Que.

Long Island—Pub. Serv. Com. of N. Y. granted petition to State Dept. of Pub. Wks. to replace existing bridge over North Hempstead turnpike, North Hempstead, N. Y., with new bridge, $281,000.

N. Y. C.—By Pub. Serv. Com. of N. Y. to eliminate River st. grade crossing, Oriskany, N. Y., by construction overpass 210 ft. southeast of present crossing, $135,900. Specifications and estimate for elimination of crossing on Syracuse-Watertown county highway, Hastings, N. Y., $155,300; estimate for elimination of Albion st. highway grade crossing, Murray, N. Y., $153,700; estimate for elimination of Colosse crossing, Mexico, N. Y., $139,200; and specifications and estimates of cost for elimination of Nichols ave. grade crossing, Syracuse, N. Y., $206,540, all approved by Pub. Serv. Com. of N. Y.

Oneida & Western—Authorized by I. C. C. to construct extension, East Jamestown, Tenn., southwesterly 9 miles, $84,000.

Term. Ry. Assn. St. Louis—City Council of East St. Louis, Ill., has passed ordinances authorizing construction of 3 east side approaches to St. Louis municipal bridge and erection of union passenger station at Railroad and South Main sts., East St. Louis, $700,000.

Projects Authorized

C. N. R.—Immediate reconstruction of dock at foot of Main st., Vancouver, B. C., destroyed by fire with loss of $1,000,000.

C. & O.—Extension of passing track and rearrangement of water facilities, Buchanan, Va., $59,600, and extension of set-off track, Burks, Va., $25,600.

N. & W.—Construction of new abutment and lengthening of bridge No. 349-A, Bristol, Va., $33,000; elimination 2 grade crossings between Blackstone, Va., and Wilson; extending and covering of platform at freight station, Columbus, Ohio; and construction concrete bridge at Marburg ave., Cincinnati, Ohio.

Bids Received

I. C.—For construction viaduct to carry Randolph st. over site of proposed suburban station, Chicago, temporary suburban station at East South Water st. and permanent station between that street and Randolph st.

L. A. & S. L.—Construction line from main line between Bracken, Nev., and Pierce to connection with proposed government road at site of Boulder dam, 22 miles.

Contracts Awarded

A. T. & S. F.—By Wichita, Kan., for construction substructure for subway at Waterman st., Wichita—List & Weatherly Construction Co., Kansas City, Mo.

Atlanta, Birmingham & Coast—Construction one-story freight warehouse, 36 ft. by 280 ft., Bellwood, Atlanta, Ga.—Capitol Const. Co., Atlanta, $30,000.

B. & O.—Construction freight terminal for use by Universal Carloading & Distributing Co., Pittsburgh, Pa including two-story office building, 45 ft. by 80 ft., two-story steel freight shed, 45 ft. by 603 ft., and 200-ft. loading platform—Ellington-Miller Co., Chicago; construction water-treating plant, Jacksonburg, W. Va.—Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

C. N. R.—Superstructure for 100-room hotel at Kent and Pownall sts., Charlottetown, P. E. I.—Foundation Martime, Ltd., Halifax, N. S.; construction subways at Gerrard st. and Carlaw ave., Toronto, Ont.—Richardson Const. Co., Toronto, $412,000; construction of overpass at Kingston road, about 10 miles east of Toronto; and for construction of subway at King's highway No. 7 on the Newmarket subdivision, Concord station, Ont.

C. P. R.—Construction of 100-room hotel at Main st. and Cornwallis ave., Kentville, N. S.—Parsons Ed. Const. Co., Moncton, N. B., $750,000.

C. & N. W.—Construction of an inbound and outbound freight station west of Orleans st. on Chicago river, Chicago—Adams Const. Co., Chicago, $125,000.

C. B. & Q.—Construction electric cinder plant, Galesburg, Ill.—Roberts & Schaefer Co., Chicago; construction two-story reinforced-concrete, brick and steel warehouse, Galesburg—Joseph E. Nelson & Sons Co., Chicago.

C. M. St. P. & P.—Excavation for depression of tracks between Galena and State sts., Milwaukee, Wis., 5,500 ft.—R. H. Gumz, Milwaukee.

D. & H.—Construction fireproof freight house, 50 ft. by 400 ft., and freight station at Wyoming ave., Scranton, Pa.—Sweeney Bros., Scranton.

Erie—Furnishing and erecting of combined N. & W. engine coaler and cinder-handling plant and sand-drying plant, Akron, Ohio—Roberts & Schaefer Co., Chicago.

Ft. Worth & Denver Northern (C. B. & Q. subsidiary)—By I. C. C. to construct line between Pampa, Tex., and Childress, 110 miles, and also for C. B. & Q. and C. R. I. & P. to construct joint line between Shamrock, Tex., and Wellington, 26 miles.

G. N.—Complete construction of this company's portion of Klamath Falls (Ore.)-Keddie (Cal.) joint line with W. P., between Klamath Falls and Bieber, Cal., 89 miles—A. Guthrie & Co., Portland, Ore.

G. C. & S. F.—Construction highway subway at Neches st., Coleman, Tex.—McCall Engineering Co., Waco, Tex., $50,000.

Ill. Term.—Furnishing of 2,000 reinforced concrete piles for use in construction of elevated line between McKinley bridge and new subway terminal at 12th st. and Lucas ave., St. Louis, Mo.—Smith & Brennen Concrete Pile Co., St. Louis; and excavation for construction of 20-story terminal and office building at 12th, High and Morgan sts. and Lucas ave., St. Louis—G. Locke Tarleton Co., St. Louis.

N. Y. C.—Alterations to mail service building at 466 Lexington ave., New York—H. D. Best, McCaffrey Co., New York; construction chain link fence between West 145th st. and Spuyten Duyvil, New York—Cyclone Fence Co., Newark, N. J.; demolition and removal of buildings on west side Manhattan—Demolition Co., Inc., New York; and construction highway viaduct, Moline, Ohio, $300,000, and construction 76-ft. track scale, Corning, Ohio, $40,000.

N. Y. C.—N. Y. C. & St. L.—Penna.—Elimination of Athol Springs road grade crossing, Hamburg, N. Y.—Bates & Rogers Const. Co., Cleveland, Ohio, $111,143.

N. Y. C. & St. L.—Construction substructure of highway bridge at Woodland ave., Cleveland, Ohio—Marsh Hart Co., $94,000; superstructure of same bridge, Bethlehem Steel Co.,

Bethlehem, Pa.; construction substructure and grading for bridge, Angola, N. Y.—H. E. Culbertson Co., $120,000; superstructure for same bridge—American Bridge Company, New York, $58,000.

N. P.—Extension to enginehouse, Duluth, Minn.—George H. Lounsbury & Son, Duluth, $42,000; construction of machine shop, Glendive, Mont.—Carl J. Steen Co., Grand Forks, N. D., $30,000.

Penna. — Installation of electrical equipment for two lift bridges over Hackensack river, Marion, N. J.—Walter J. Coleman, Jersey City, N. J., $100,000; construction of coal silos at Belmont ave. and Thompson st., Philadelphia, Pa.—Nicholson Co., Inc., New York, $72,500.

P. M.—Designing and erecting 300-ton reinforced concrete 3-track shallow-pit locomotive coaling plant, New Buffalo, Mich.—Roberts & Schaefer Co., Chicago.

P. & W. V.—Construction of branch line, Jacob's creek, Pa., to connection with Donora Southern, 5.75 miles—Vang Const. Co., Pittsburgh, Pa., $1,750,000.

S. L.-S. F.—Construction of extension between Shamrock, Okla., and Drumright, 3 miles—Allhands & Davis, Joplin, Mo., $120,000; and willow mattress and rip-rap bank protection work along Mississippi river, Memphis, Tenn.—Massman Const. Co., Kansas City, Mo., $150,000.

Term. Ry. Assn. St. Louis—Clearing of site and excavating for Merchandise Mart at 12th, Spruce, 13th and Poplar sts., St. Louis, Mo.—Excavating Company, St. Louis, Mo.; 6,000 reinforced concrete piles for use in construction of merchandise mart—Smith & Brennen Concrete Pile Co., St. Louis, $225,000.

T. & P.—St. L.-S. F.—Construction highway subway at Henderson st., Ft. Worth, Tex.—H. K. McCollum, Ft. Worth, $491,000.

U. P.—Construction of electric cinder plant, Hastings, Neb.—Roberts & Schaefer Co., Chicago; grading for new freight classification yard with accompanying facilities, Cheyenne, Wyo., including westbound and eastbound train yards and car-repair facilities and for construction substructure for 12-track bridge over Crow creek at same point—Utah Const. Co., Ogden, Utah, total cost, $1,860,000.

Union Terminal Co.—Construction of highway subway at Cadiz st., Dallas, Tex.—T. H. Johnson, Dallas, $160,000.

Virginian—Fabrication of steel for new bridge over Kanawha river, Deep Water, W. Va.—Virginia Bridge & Iron Co., Roanoke, Va.

Wab.—Construction of substructure, including concrete piers, of double-track bridge to be constructed over Missouri river, St. Charles, Mo.—Missouri Valley Bridge & Iron Co., Leavenworth, Kan.

W. P.—G. N.—By W. P. for construction of line, Keddie, Cal., to Bieber, 112 miles, as its portion of joint line with G. N., from Keddie, Cal., to Klamath Falls, Ore.—W. A. Bechtel Co. and Utah Const. Co., joint bidders.

Supply Trade News

General

The Chicago Bridge & Iron Works, Chicago, has opened a district sales office at Tulsa, Okla. **D. A. Leach** is in charge.

The American Fork & Hoe Co., Cleveland, Ohio, has acquired control of the **Skelton Shovel Company,** Dunkirk, N. Y., and the **Kelley Axe & Tool Co.,** Charleston, W. Va.

The Inland Steel Company, Chicago, has recently completed a new merchant bar mill at its Indiana Harbor (Ind.) works, making the third bar mill which this company has at that location.

The Curtin-Howe Corporation, New York, has moved its Chicago office from 410 North Michigan avenue to 20 North Wacker drive and has announced the establishment of a new office in the Security building, Minneapolis, Minn., in charge of **D. R. Manuel,** northwestern manager, who was formerly located at Spokane, Wash.

Personal

James H. Edwards, chief engineer of the American Bridge Company, New York, died in that city on August 14, at the age of 66 years.

C. T. Connelly, representative of the **Independent Pneumatic Tool Company,** Chicago, with headquarters at Detroit, Mich., has been appointed manager of the Buffalo (N. Y.) office.

John M. Mulholand, sales representative of the **O. F. Jordan Company,** East Chicago, Ind., has been elected vice-president in charge of sales to succeed **A. L. Greenabaum,** deceased.

William Dudley Foulke, for many years treasurer of the Western Wheeled Scraper Company, Aurora, Ill., died on July 23, at the age of 62. In 1894, Mr.

William Dudley Foulke

Foulke joined the organization with which he became so closely identified, then being advanced until he became treasurer. Much of the development of the Western Wheeled Scraper Company has been ascribed to his judgment and initiative.

D. C. Jones, who has been appointed vice-president of the **Ayer & Lord Tie Company,** Chicago, was born near Bangor, Wis., on January 7, 1879, and entered the employ of the Ayer & Lord Tie Company at Chicago on October

D. C. Jones

1, 1899. On January 1, 1901, he was transferred to the branch office at DeValls Bluff, Ark., and then to the timber products production department at Carbondale, Ill., on May 15, 1902. Thereafter, he worked successively through the branch headquarters of the production department at DeValls Bluff, South McAleaser, Okla.; Ola., Ark.; Little Rock; Memphis, Tenn.; Peducah, Ky., and Burnside in the capacities of production superintendent and general production superintendent. He was transferred from Peducah, Ky., to the main office in Chicago on November 1, 1923, where he served as general production superintendent until his recent promotion.

Walter Blocher, representative of the **Central Alloy Steel Corporation,** Massillon, Ohio, with headquarters at Indianapolis, Ind., has been appointed assistant district sales manager of the **Republic Steel Corporation,** Youngstown, Ohio, with headquarters at Pittsburgh, Pa. Mr. Blocher succeeds **Arthur Vogt,** who has resigned to become district sales manager of the **Associated Alloy Steel Company,** with headquarters at Cleveland, Ohio.

H. W. Protzeller, development engineer of the **O. F. Jordan Company,** East Chicago, Ind., has resigned to become engineer, maintenance of equipment, of **Fairmont Railway Motors, Inc.,** Chicago. He was born in 1886 in Allentown, Pa., and was graduated from Lehigh University. He then entered the employ of the General Electric Company where he spent several years in the construction department installing railway equipment. He resigned from this company to become assistant superintendent of the Twin

City Rapid Transit Company, Minneapolis, Minn., and three years later became general superintendent of transportation of St. Mary's Traction Company, Sault Ste. Marie, Mich., and Ont. After holding this position for two years, he served as consulting engineer for electric railways in Minnesota, Michigan and Illinois for a period of two years. During the next eight years he organized and built the Minnesota Northwestern Electric Railway and

H. W. Protzeller

operated it as general manager. In 1914 he entered the employ of the O. F. Jordan Company as development engineer, which position he has held until his resignation.

Trade Publications

Rotator Hammer Drills.—Bulletin 87-C of the Sullivan Machinery Company, Chicago, which has been issued recently, describes and illustrates the L-8 type rotator rock drill for general rock excavation.

Wood Preservation.—A folder which lists the advantages of the ZMA method of preserving wood, and also the companies licensed to use this preservative, has been issued by the Curtin-Howe Corporation, New York.

Ground Pressure Data.—The Northwest Engineering Company, Chicago, recently issued a pamphlet bearing this title, which discusses the question of ground pressure relative to the design of crawler treads, with particular reference to their length.

Fumigation.—The Calcyanide Company, New York, has issued an eight-page booklet on the use of its calcyanide fumigants for camp cars and other railway housing facilities, describing means for combating insects and rodents and the use of their materials for this purpose.

Dump Cars and Grading Equipment.—This is the title of Catalog No. 80 of 144 pages which is being distributed by the Western Wheeled Scraper Company, Aurora, Ill. This catalog contains descriptions as well as explanations of the uses of the complete line of dump cars and ditching and grading equipment which is manufactured by this company. The book is bound attractively and is complete with numerous illustrations of Western Wheeled Scraper equipment, some in actual use.

Bolts and Nuts.—The Dardelet Threadlock Corporation, N. Y., has issued a 16-page booklet describing and illustrating Dardelet bolts and nuts for rail joints, frogs and guard rails. The principle of the Dardelet self-locking screw thread is explained in detail and the various features of this type of thread are discussed.

CP Demolition Tools and Sheeting Driver.—The Chicago Pneumatic Tool Company has issued an informative 12-page booklet, designated as No. 865, which deals specifically with the construction and application of its air-operated demolition tools and sheeting driver.

Large Diameter Cast Iron Pipe.—The United States Pipe and Foundry Company, Burlington, N. J., has recently issued a 24-page book which is devoted entirely to construction views and short descriptions of installations of large diameter cast iron pipe in various large cities in this country. The book is attractively bound.

Portable Air Compressors.—A 40-page catalogue, designated as bulletin No. 83-R, which contains valuable information in regard to Sullivan portable air compressors, has recently been published by the Sullivan Machinery Company, Chicago. The bulletin is profusely illustrated with views of this equipment as well as of its many applications.

Two-Piece Retaining Wall.—The Federal Cement Tile Company, Chicago, has issued a 16-page bulletin describing and illustrating a variety of applications of the Federal concrete cribbing. In addition to photographs and descriptions of installations, detailed drawings are included which show the dimensions necessary for the application of this type of construction to any particular purpose.

Ideal Posts.—The American Steel & Wire Company has issued an eight-page folder giving the dimensions, properties and advantages of its U-type steel fence posts, explaining methods of driving, attaching wire fencing, etc. Space is also allotted to data and sketches relating to galvanized end, gate and corner posts and the Gray angle, end and corner posts.

Scientific Water Correction.—Scale formation, corrosion and foaming in steam boilers, their causes and methods of prevention are reviewed concisely in a cloth-bound book of 95 pages just issued by the Dearborn Chemical Company, Chicago. The treatment is built around the water treatment processes and service of this company, with particular reference to the new laboratory which is depicted in a number of photographs. Space is also devoted to the subject of embrittlement and to the various products of the Dearborn Company. The presentation is attractive and is supplemented by illustrations.

Personal Mention

General

H. C. Youngs, lumber buyer for the Chicago, Milwaukee, St. Paul & Pacific, has been promoted to tie and timber agent, with headquarters as before at Chicago, succeeding **F. S. Pooler,** who has retired.

H. D. Jouett, who was chief engineer in charge of the construction of the Cleveland (Ohio) Union Terminal, which was recently completed, has also been appointed terminal manager with jurisdiction over the maintenance, operation and management of the terminal.

C. H. Miller, maintenance of way foreman for the stores department of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Beech Grove, Ind., and formerly supervisor of bridges and buildings on that road, has retired after more than 47 years of service with the Big Four.

Engineering

W. F. McDonald, division engineer of the Spokane division of the Chicago, Milwaukee, St. Paul & Pacific, at Spokane, Wash., has been promoted to assistant engineer, maintenance of way, of the lines west of Mobridge, S. D., succeeding **J. F. Pinson,** who has been assigned to other duties.

E. R. Parke, division engineer in the office of the chief engineer of the Pennsylvania, with headquarters at Philadelphia, Pa., has been transferred to the Sunbury division, with headquarters at Sunbury, Pa., where he succeeds **F. R. Rex,** who has been transferred to the Williamsport division, with headquarters at Williamsport, Pa. Mr. Rex relieves **N. D. Vernon,** who has been transferred to the Elmira division, with headquarters at Elmira, N. Y., where he replaces **David Davis, Jr.,** who has been transferred to the office of the chief engineer, with headquarters at Philadelphia. **L. B. Young,** division engineer of the Monongahela division, with headquarters at Uniontown, Pa., has been appointed division engineer of the Schuylkill division, a newly created position. **Vernon W. Gray,** assistant supervisor on the Delmarva division, has been promoted to engineer-draftsman on the Baltimore improvement work with headquarters at Baltimore, Md. **J. L. Gwin,** chief draftsman on the Cresson division at the time of its consolidation with the Pittsburgh division on April 15 of this year, has retired after 37 years with the Pennsylvania and with a total of 46 years of railway service.

J. C. Starkie has been appointed division engineer on the Gulf Colorado & Santa Fe (part of the Atchison, Topeka & Santa Fe System), with headquarters at Temple, Tex., to replace **W. W. Wilson,** who has been promoted to the position of district engineer with,

headquarters at Galveston, Tex. Mr. Wilson takes the place of **K. B. Duncan,** who has been promoted to chief engineer of the G. C. & S. F., with the same headquarters, succeeding **Frank Merritt,** whose death is noted elsewhere in these columns.

Mr. Duncan has served a total of 31 years in the engineering departments of three roads. He was born on September 5, 1878, at Princeton, Ind., and received his higher education at Purdue University, from which he graduated in 1902. He commenced his railway career in November, 1899, as an instrumentman on the Cleveland, Cincinnati, Chicago & St. Louis. From 1903 to 1904, he served as draftsman on the G. C. & S. F., returning to Purdue University on the latter date as an instructor. He returned to railway service in 1905 as resident and division engineer on the construction of the Houston & Texas Central (now part of the Southern Pacific). In 1908 Mr.

K. B. Duncan

Duncan was appointed office engineer on the G. C. & S. F. and in 1913 he was made engineer of that road. He was promoted to valuation engineer in 1915, being further promoted to district engineer at Galveston in 1918, which position he retained until his recent promotion to chief engineer.

G. J. Nash, supervisor of track on the Chicago Terminal division of the Illinois Central, with headquarters at Chicago, has been appointed assistant engineer at Dubuque, Iowa, where he replaces **A. F. Dyer,** who has been assigned to other duties. The position of supervisor at Chicago has been discontinued.

Track

O. Hanson has been appointed roadmaster on the Edmonton division of the Canadian National, with headquarters at Edmonton, Alta., to succeed **J. Henry,** deceased.

J. A. MacGregor has been appointed acting roadmaster on the Saskatoon division of the Canadian Pacific, with headquarters at Wilkie, Sask., in the absence of **J. Sewell.**

R. R. McDuff, roadmaster on the Houston division of the Southern Pacific, with headquarters at Yoakum, Tex., has been transferred to the El Paso division, with headquarters at Del Rio, Tex., succeeding **R. B. Melton,** who has been assigned to duties in the engineering department at El Paso, Tex.

Walter Chaffee of the track department of the New York, New Haven & Hartford, has been appointed assistant track supervisor at New London, Conn., to succeed **W. W. Fannon,** who has been transferred to New Haven, Conn., replacing **Frank Cronin,** who has been promoted to track supervisor with headquarters at Great Barrington, Mass., to succeed **M. B. McArdle,** deceased.

O. O. Osborne, whose promotion to roadmaster on the Chicago, Indianapolis & Louisville (the Monon), with headquarters at Lafayette, Ind., was noted in the August issue, was born on August 31, 1891, at Rensselaer, Ind., and received his education at Purdue University. He entered railway service on March 3, 1917, with the Monon and shortly thereafter entered the United States Army from which he was discharged in July, 1919, returning then to the Monon as an assistant engineer. On January 1, 1930, he was appointed acting roadmaster, which position he held until his recent promotion.

G. Brown, whose promotion to roadmaster on the Melville division of the Canadian National, with headquarters at Melville, Sask., was announced in the August issue, was born on January 12, 1890, in England. He entered railway service on May 20, 1906, as a trackman on the Canadian Northern (now part of the Canadian National) and was promoted to track foreman at Watson, Sask., in July, 1910. In June, 1911, he entered the service of the Grand Trunk Pacific (now also part of the Canadian National) as a track foreman, since which time he had served in this position and as extra gang foreman and snow plow foreman until his recent promotion to roadmaster.

C. D. Prentice, whose promotion to track supervisor on the New York, New Haven & Hartford, with headquarters at Putnam, Conn., was noted in the August issue, was born on August 4, 1893, in New York City and received his higher education at the Sheffield Scientific School (Yale University), from which he graduated in 1916. He entered railway service as a chainman in the maintenance-of-way department of the New Haven on July 5, 1916, with headquarters at New London, Conn., and in November, 1916, was promoted to inspector with the same headquarters. In May, 1917, he was promoted to transitman with the same headquarters and in September of that year he was made a draftsman in the construction department, with headquarters at New Haven, Conn. In July, 1920, he was transferred to the Danbury division as a transitman, with headquarters at Danbury, Conn., and in September, 1923, he was made cost engineer with the same headquarters. In February, 1926, he was promoted to assistant engineer on the Waterbury division with headquarters at Waterbury, Conn., and in November, 1928, he was appointed assistant track supervisor with the same headquarters, which position he was holding at the time of his recent promotion to track supervisor.

Changes on the Pennsylvania

D. Devore, track foreman on the Ft. Wayne division of the Pennsylvania, has been promoted to assistant supervisor on the Ft. Wayne division, with headquarters at Upper Sandusdy, Ohio, where he replaces **H. D. VanVranken,** who has been promoted to supervisor on the Grand Rapids division, with headquarters at Petoskey, Mich., to replace **A. M. Lood,** who has been transferred to Kalamazoo, Mich., on the same division. Mr. Lood succeeds **Thomas Stewart,** whose retirement was mentioned in the July issue. **H. Hill,** assistant supervisor on the Pittsburgh division, with headquarters at Johnstown, Pa., has been promoted to supervisor on the Ft. Wayne division, with headquarters at Ft. Wayne, Ind., to succeed **E. L. Oberkiser. J. C. Buzard,** supervisor on the Buffalo division, with headquarters at Titusville, Pa., has been appointed assistant supervisor at Johnstown, to succeed Mr. Hill. The position of supervisor at Titusville has been discontinued. **C. W. Robinson,** assistant supervisor on the Buffalo division, with headquarters at Buffalo, N. Y., has been transferred to Canton, Ohio, where he relieves **C. R. Sanders,** who is on leave of absence. **T. E. Boyle,** assistant on the engineer corps of the Toledo division, has been promoted to assistant supervisor on the Ft. Wayne division, with headquarters at Crestline, Ohio, and **G. D. Dowden,** gang foreman on the Indianapolis division, has been promoted to assistant supervisor on the Toledo division.

L. G. Walker, Jr., assistant on the engineer corps, with headquarters at Chambersburg, Pa., has been promoted to assistant supervisor, with the same headquarters, to succeed **W. H. Heims,** who has been transferred to Camden, N. J., where he relieves **L. P. Oelschlager,** who has been transferred to Harrington, Del. Mr. Oelschlager succeeds **Vernon W. Gray,** whose promotion to engineer-draftsman is noted elsewhere in these columns. **F. M. Connolly,** supervisor of track on the Eastern division with headquarters at Loudonville, Ohio, retired from active service on August 1, after 29 years of service with that road.

Bridge and Building

W. T. Sprague, assistant supervisor of bridges and buildings of the Beaumont division of the Texas & New Orleans (part of the Southern Pacific), with headquarters at Houston, Tex., has been promoted to supervisor of

bridges and buildings of the Victoria division, with headquarters at Victoria, Tex., succeeding **G. C. Fullick,** whose death is noted elsewhere in these columns.

J. D. Searles has been appointed bridge and building supervisor with the Oregon-Washington Railroad & Navigation Company, with headquarters at Walla Walla, Wash., succeeding **W. S. Miller,** who has been transferred to Spokane, Wash., to replace **J. Mendenhall.**

Charles Soard, bridge erector on the Louisville division of the Louisville & Nashville, has been promoted to supervisor of bridges and buildings on the Evansville division, with headquarters at Evansville, Ind., where he succeeds **A. B. McVay,** who has retired after 55 years of service with the L. & N. **William Sheley,** assistant supervisor of bridges and buildings on the Evansville division, with headquarters at Evansville, has also retired, having been in the employ of the L. & N. for 43 years. **R. O. Elliot,** supervisor of bridges and buildings on the Nashville division, with headquarters at Nashville, Tenn., has retired after 34 years of service.

Mr. Soard first entered railway service on September 1, 1911, as a laborer in the bridge and building department of the L. & N. and in November of the following year, he was promoted to carpenter, which position he held until 1920, when he was further promoted to bridge and building foreman. In 1926, Mr. Soard was promoted to bridge erector on the Evansville division, holding this position until his recent promotion.

P. R. Glassburn, whose promotion to supervisor of bridges and buildings on the Union Pacific was announced in the August issue, was born on September 23, 1890, at Valparaiso, Neb., and after obtaining his high school education entered the service of the U. P. at the age of 15 years as a trackman on the Nebraska division. He served in this capacity and as a track foreman until November, 1908, when he was transferred to the bridge and building department as a carpenter, being promoted to bridge and building foreman in June, 1913. In August, 1917, Mr. Glassburn was appointed clerk to the supervisor of bridges and buildings, which position he held until May, 1920, when he returned to the position of bridge and building foreman. Three years later he was transferred to the office of the engineer maintenance of way as a clerk, being, in June, 1928, appointed assistant supervisor of bridges and buildings, with headquarters at Omaha, Neb. He retained this position until July 10 of this year when he received his recent promotion.

Water Service

Charles Rodman has been appointed acting general water service foreman of the Los Angeles division of the Los Angeles & Salt Lake (part of the Union Pacific), with headquarters at Los Angeles, Cal., succeeding **Frank Cornelius.**

W. S. Clark, supervisor of bridges and buildings on the Missouri Pacific, with headquarters at Kansas City, Mo., has assumed the duties of **F. G. Clements,** supervisor of water service, with the same headquarters, whose death was noted in the July issue.

Obituary

G. C. Fullick, supervisor of bridges and buildings on the Victoria division of the Texas & New Orleans (part of the Southern Pacific), with headquarters at Victoria, Tex., died at his home on July 13 after an illness of only a few hours duration. Mr. Fullick was born in Horton, England, on August 2, 1867, and came to this country at the age of two years, entering the service of the bridge and building department of the Southern Pacific in 1885. He resigned in 1895 to enter business for himself at Hempstead, Tex., but again took up railway service in 1899 as assistant bridge and building foreman on the Victoria division of the T. & N. O. In June, 1905, Mr. Fullick was promoted to bridge and building foreman on the same division, in which position he served until 1922, when he was promoted to general foreman in charge of a ballast gang. He was further promoted to supervisor of bridges and buildings on the Victoria division in May, 1925, retaining this position until his death.

Frank Merritt, chief engineer of the Gulf, Colorado & Santa Fe (part of the Atchison, Topeka & Santa Fe), with headquarters at Galveston, Tex., died on August 3 at the age of 74 years. Mr. Merritt was born on June 11, 1856, at Scituate, Mass., and graduated from Tufts College in 1879. He entered the service of the Atchison,

Frank Merritt

Topeka & Santa Fe as an axman on location in 1881, being then advanced successively through the positions of levelman and track engineer. Mr. Merritt later spent one year on land surveys and three years on city and hydraulic engineering, returning eventually to the Santa Fe where he served for one year as levelman, two years as transitman, three years on maintenance of way work, eight years on construction and five years on reconnoissance and location. In 1900 he was appointed assistant engineer and two years later he was promoted to resident engineer, being, on November 10, 1909, promoted to chief engineer of the G. C. & S. F., which position he held until his death.

William Albert McGonagle, president of the Duluth, Missabe & Northern and of the Duluth & Iron Range, and formerly assistant chief engineer of the D. & I. R., died at his home at Duluth, Minn., on August 2 from heart disease. Mr. McGonagle was one of the founders of the American Railway Bridge and Building Association, serv-

William Albert McGonagle

ing as its president in 1895-1896 and maintaining an active interest in its affairs up to the time of his death. He was born at Conshohocken, Pa., on March 28, 1861, and graduated from high school in that city in 1876. He graduated from the University of Pennsylvania in 1881 and entered railway service in the same year as draftsman on the Northern Pacific at Brainerd, Minn. From 1882 to 1890, Mr. McGonagle served as an assistant engineer on the D. & I. R., then being promoted to resident engineer and superintendent of bridges and buildings. He became assistant chief engineer of the D. & I. R. in 1901 and in the following year was appointed assistant to the president of the Duluth, Missabe & Northern. In 1903, he was elected first vice-president and general manager and in 1909, he was elected president of the road. From the latter date until 1918 he also served as general manager of the D. M. & N. Mr. McGonagle was also made president of the D. & I. R. on Jan. 10, 1930.

RAILWAY TRAVEL SAFER.—Passengers traveling by airplane incur a hazard 22 times greater than when traveling by railroad, according to the Actuarial Society of America. The number of airplane passengers killed is said to be one in every five thousand, the figures being based on a survey covering scheduled air lines.

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